

AUTOMOTIVE *and Aviation* INDUSTRIES

APRIL 1, 1944



Why this demand for ball bearings?

● Since they are *one* product that is common to almost every other, in which parts must oscillate or revolve, it is not surprising that this enormous demand should develop.

New Departure alone is producing as many as were made in *all* America before the war.

This ability to get things done even under the most difficult conditions, will prove increasingly helpful to those who have bearing problems.

New Departure, Division of General Motors Corporation, Bristol, Connecticut.

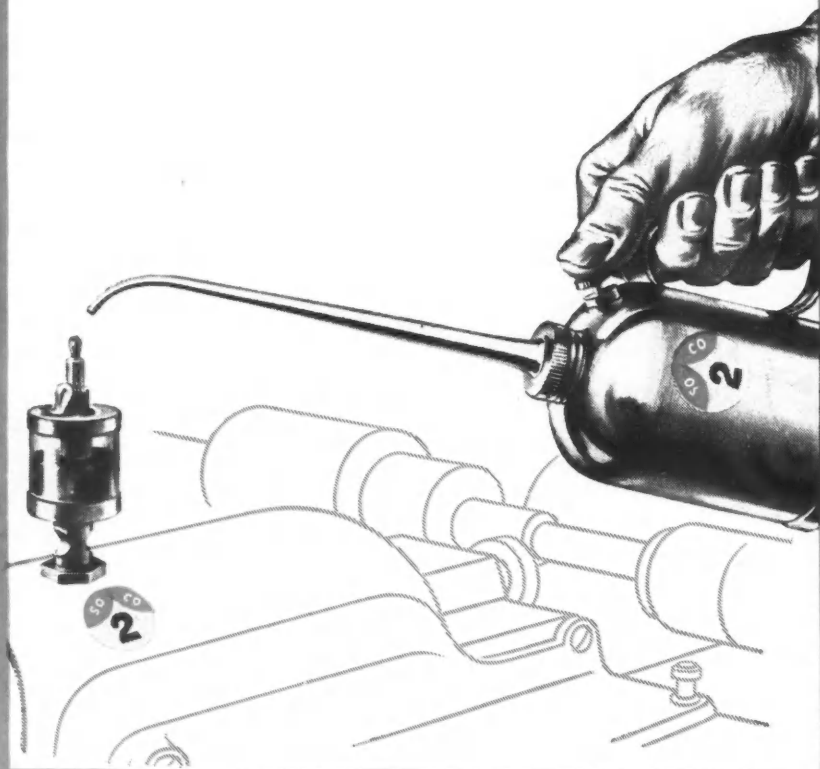
3244

NEW DEPARTURE

BALL BEARINGS

NOTHING ROLLS LIKE A BALL

It's "Blunder-proof"



Announcing . . .

Standard Coded Lubrication Service

. . . planned to get the right lubricants to all the right places!

No one knows better than the man in charge of your lubrication, the *need* for this simple, "blunder-proof" coded system.

Each separate lubricant used in your plant is given its own code number. *Every* lubrication point requiring that particular lubricant, and *every* container or device handling the servicing lubricant is clearly marked with a bright decalomania transfer bearing its code number.

When this simple code system is followed, no point of lubrication can receive the *wrong* lubricant—points requiring lubrication are easier to see—less reliance must be placed on the memory of your oilers.

Standard Coded Lubrication Service is carefully planned to simplify, not complicate your lubrication problems. It not

only makes easier and more effective the work of your oiler crews—makes inexperienced oilers almost as reliable as old hands—but also, it immediately clarifies and simplifies the efforts of the *men in charge* of this important part of your operations.

This Coded Service is at *your* service—without cost—if your plant is located in the Middle West.

Considerable advance demand was created when this plan was first submitted to representative industrial groups. Materials are being produced as fast as wartime conditions permit. We suggest you get your request on file at your nearest Standard Oil office.

Oil is Ammunition . . . Use it Wisely

FREE BOOKLET TELLS HOW

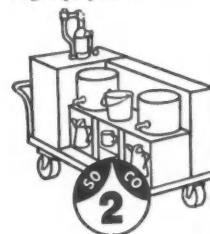
this simple code system may be fitted to your lubrication plan:

Flexibility and adaptability are outstanding features of this system. Note that it is a *numerical* system not to be confused with complex "color scheme" systems. Here are the few simple steps in this plan. A code number is assigned to each lubricant in your plant. Numbered decalomania transfers are furnished by us in quantities sufficient to be applied to:



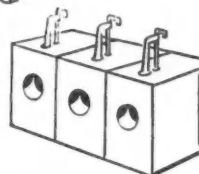
—every point of lubrication on every machine

—every grease gun or oil can used in servicing equipment



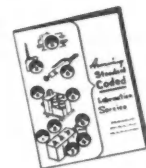
—every container or drum on your lubrication cart where they are used

and every barrel, drum, or storage tank in your oil house.



Machine Record Cards: Where desired, a supply of machine record cards (4"x6") is provided.

Lubrication Chart: For control purposes, a card is provided to list, by brand name and code numbers, all lubricants used in the plant. This card is used by stock clerk or stock-keeper to enable him to requisition products by brand name, and to mark barrels with the correct code numbered decal.



This Booklet gives full details of how Standard Coded Lubrication Service can go to work in your plant. Ask your Standard Oil Man for a copy. Talk it

over with him and the men in charge of your lubrication. See how this plan fills a gap in your lubrication program. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 5, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**

★ LUBRICATION ENGINEERING

'Travel-mix' plants dish it out!



ANOTHER COTTA "ENGINEERED-TO-ORDER" TRANSMISSION FOR PIONEER ENGINEERING WORKS

● Steady as a clock, rugged Pioneer Travel-Mix Plants churn out the right mix under all conditions . . . airport or highway, up grade or down! One of the features of this ingenious machine is its higher pugmill speeds, obtained by means of COTTA 2-speed heavy-duty transmissions . . . Like Pioneer, many other leaders in the heavy duty machinery field come to COTTA for smooth, quiet, highly efficient, low-cost transmission of power . . . *engineered to order.* COTTA custom-designed transmissions are specified for oil-well drilling rigs, locomotive cranes,

Diesel locomotives, power excavators, mine sweepers. We'll be glad to send views of transmissions-on-the-job . . . or give specific help on your current engineering problem. Write today!

COTTA TRANSMISSION CORP., ROCKFORD, ILLINOIS



COTTA
HEAVY-DUTY
TRANSMISSIONS

PRECISION-BUILT • SPECIALLY
ENGINEERED FOR YOUR PRODUCT



NICKEL AIDS THE ELECTRICAL EQUIPMENT INDUSTRY *to KEEP 'EM OPERATING!*

ELECTRICAL ENGINEERS continue their spectacular progress.

Since Pearl Harbor they have designed and perfected equipment that frees military strategy from many of its old limitations.

Through tireless motors big and small, through tiny electronic tubes and gigantic motor generators, through a myriad of instruments and machines these men have put electrical energy to work for Victory.

Constantly striving to improve its products, the electrical industry has acquired long experience with metals and alloys of many kinds.

This experience has demonstrated that when properly used, nothing quite

takes the place of Nickel. From resistor grids to armature shafts, from limit switches to reduction gears, Nickel and its alloys have been assuring the dependability so important in equipment that must not fail . . . even under war-time overloads.

Nickel imparts toughness, strength, and fatigue resistance to other metals . . . makes them stand up better under abrasion, wear, shock, and stress.

As in other industrial fields, a little Nickel goes a long way to keep electrical equipment operating.

For years we have enjoyed the privilege of cooperating with technical men of the electrical equipment industry . . . and of many others. Whatever your in-

dustry may be . . . if you want help in the selection, fabrication, and heat treatment of alloys . . . we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?



★ **Nickel** ★

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.

When writing to advertisers please mention **AUTOMOTIVE and AVIATION INDUSTRIES**

AUTOMOTIVE and Aviation INDUSTRIES

Vol. 90

Published Semi-Monthly
April 1, 1944

Number 7

JULIAN CHASE, Directing Editor
J. R. CUSTER, Associate Editor
JOS. GESCHELIN, Detroit Editor
JEROME H. FARRIS, Ass't Editor
E. L. WARNER, JR., Associate Editor
MARCUS AINSWORTH, Statistician
H. H. ROBERTS, Ass't Editor
L. W. MOFFETT, Washington Editor
HOWARD KOHLBRENNER, Art Editor
J. D. BROWNE, Washington News Ed.
EUGENE J. HARRY, Washington Asst. Ed.
R. RAYMOND KAY, West Coast
MARCUS W. BOURDOY, British

CONTENTS

Car Builders Plan Improvements in Postwar Parts Distribution. <i>By E. L. Warner, Jr.</i>	17
Morse Chain Production Facilities Quickly Adapted to War Products. <i>By Joseph Geschelin</i>	18
High Performance Fighters. <i>By Kurt Tank</i>	22
Production Problems of Exhaust Collector Rings. <i>By Eric O. Johnson</i>	24
Diversity Marks the Continental Line of Mechanical Rubber Products. <i>By Joseph Geschelin</i>	28
Magnesium in Aircraft. <i>By J. C. Mathes</i>	31
Military Truck Performance. <i>By Major Edward H. Holtzkemper</i>	32
Retractable Ball Turret	36
New Production Equipment	37
New Hendy Series 50 Diesel	39
Forming Properties of Vulcanized Fiber Sheet. <i>By C. A. Hedges</i>	40
New Products	41
Endurance Tests Prove Quality of Gang-Riveted Joints. <i>By L. P. Spalding</i>	43
New Products for Aircraft	44
News of the Industry	45
Calendar of Coming Events	48
Advertisers' Index	144

Copyright 1944 by Chilton Company (Inc.)

Automotive Division

Jos. S. HILDRETH, President and Manager
JULIAN CHASE, Vice Pres. G. C. BUZBY, Vice Pres.

OFFICES

Philadelphia 39, Pa., Chestnut & 56th Sts., Phone Sherwood 1424
New York 17, N. Y., 100 East 42nd St., Phone Murray Hill 5-8600;
Chicago 1, Ill., Room 916 London Guarantee & Accident Building, Phone Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison 2090; Cleveland 14, Ohio, 609 Guardian Bldg., Phone Cherry 4188; Washington 1, D. C., 1061 National Press Bldg., Phone District 8109 and 8110;
San Francisco 5, Calif., 605 Market St., Room 708, Phone Douglas 0967;
Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.
Cable Address:Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors

C. A. MUSSELMAN, President
Vice-Presidents

JOS. S. HILDRETH
EVERETT B. TERHUNE
WILLIAM A. BARBER, Treasurer
JULIAN CHASE
P. M. FAIRENDORF
J. H. VAN DEVENTER
JOHN BLAIR MOFFETT, Secretary
THOMAS L. KANE
HARRY V. DUFFY
GEORGE H. GRIFFITHS
C. S. BAUR
G. C. BUZBY
CHARLES J. HEALE

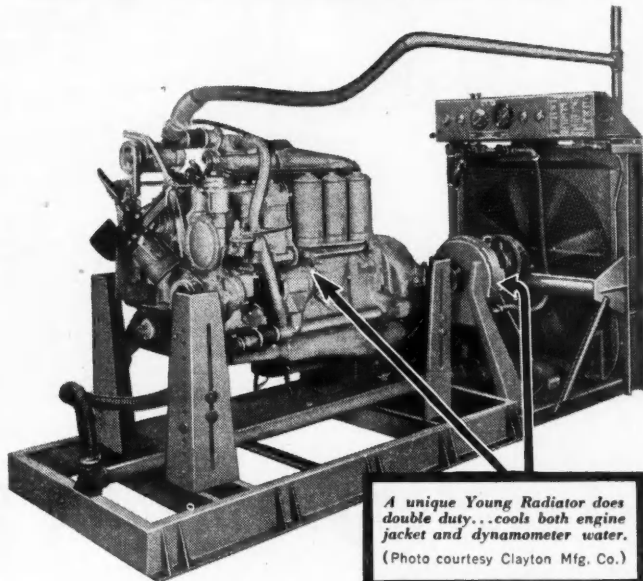
April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

AUTOMOTIVE and AVIATION INDUSTRIES, Vol. 90, No. 7. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign \$2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

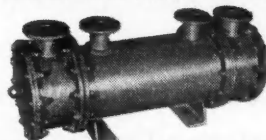
ANOTHER
EXAMPLE OF
YOUNG
ENGINEERING
SERVICE

A RADIATOR THAT LEADS A DOUBLE LIFE



A unique Young Radiator does double duty...cools both engine jacket and dynamometer water.
(Photo courtesy Clayton Mfg. Co.)

★ Run-in tests of new and rebuilt engines are now simplified and speeded up by a new type hydraulic dynamometer that requires no outside electric current or coolant supply. Engine and power absorption heat loads are handled by a double duty radiator designed by Young Heat Transfer Engineers. One section cools the jacket water of the engine on test and another cools the water of the dynamometer. Other Young units are doing equally unusual jobs on land, sea, and in the air. Whatever your heat transfer problem may be, Young engineers can help you to a solution.



Young Tube Bundle and Shell Heat Exchangers are used in aircraft engine run-in tests. At the start live steam is run through them to quickly bring tube oil up to operating temperature, then cold water to carry off excessive engine heat. Tube bundle has free expansion and contraction features. Easily installed and serviced.

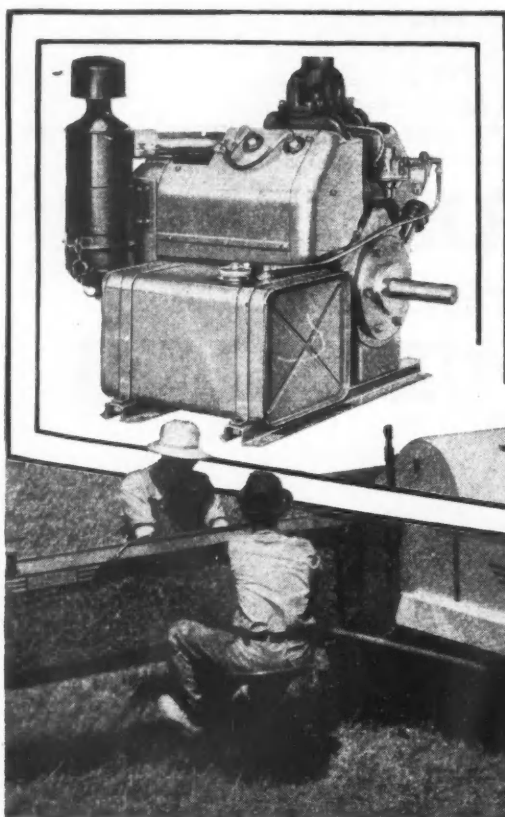
YOUNG

BUY BONDS
PRODUCE MORE
SALVAGE SCRAP
WIN THE WAR

HEAT TRANSFER ENGINEERS

Manufacturers of Oil Coolers • Gas, Gasoline, Diesel Engine Cooling Radiators • Intercoolers • Heat Exchangers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air Conditioning Units • Heating Coils • Cooling Coils • and a Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR CO., Dept. 214D, RACINE, WIS.



"Packaged Power" for Many Uses

The compact Wisconsin aircooled engine is used by over 350 manufacturers — for tractors and farm machinery and as a dependable, efficient source of power for a variety of applications in construction and industry.

United Air Cleaners are standard equipment on Wisconsin motors. Model VE-4, shown at left, powers this Case Sliced-Hay Pick-Up Baler.

Let your engine breathe *Clean Air*

An internally clean engine is a vastly better performing, more economical, longer lasting engine.

United Oil Bath Air Cleaners and pre-cleaners are keeping dust, the arch enemy of machinery, out of thousands of internal combustion engines now engaged in important military work—just as United equipment has for many years been protecting passenger cars and trucks, tractors and farm machinery, and stationary engines.

New United models, born of this specialized experience, will provide even better protection for the improved engines sure to come after the war. In planning installations for your new designs you may find our experience useful. Our sales engineers are always available for helpful discussions.

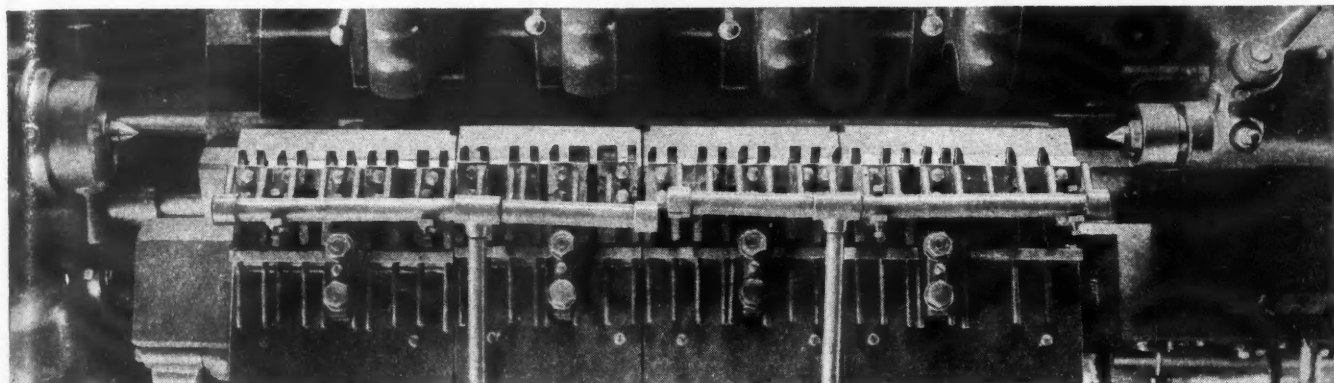


This United Oil Bath Air Cleaner, Model CT50-10490, is installed on the Wisconsin VE-4 Motor whenever engine is sold as a stripped unit.

UNITED SPECIALTIES COMPANY
 UNITED AIR CLEANER DIVISION • CHICAGO 28, ILLINOIS
 MITCHELL DIVISION • PHILADELPHIA 36, PA.

AIR CLEANERS ★ METAL STAMPINGS ★ HIGH PRESSURE HOSE CLAMPS
 ★ IGNITION SWITCHES ★ ROLLED SHAPES ★ DOVETAILS

Lo-swing LATHES ON CAMSHAFT WORK



● Lathe work on forged camshafts is usually divided into two or three turning operations: First, the squaring of the sides of the cams, gears and bearings; second, the turning between cams, and third, special machining operations when required.

The above illustration shows the type of tooling used for the squaring of all cams, bearings, gears, etc., in a single operation—thereby assuring the close accuracy required in the spacing of cams on modern aircraft and other types of internal combustion motors.

The squaring tools are usually mounted in 4 cam-controlled slides, each slide timed to feed in a pre-determined sequence. Thus, in the case illustrated above only one set of tools is cutting into the line bearing at any time thereby eliminating any danger of twisting or setting up strain in the shaft. Note the four sturdy roller steady rests for supporting the work and taking the cutting pressure from the tools. These rests are of the hinged type to facilitate loading and unloading.

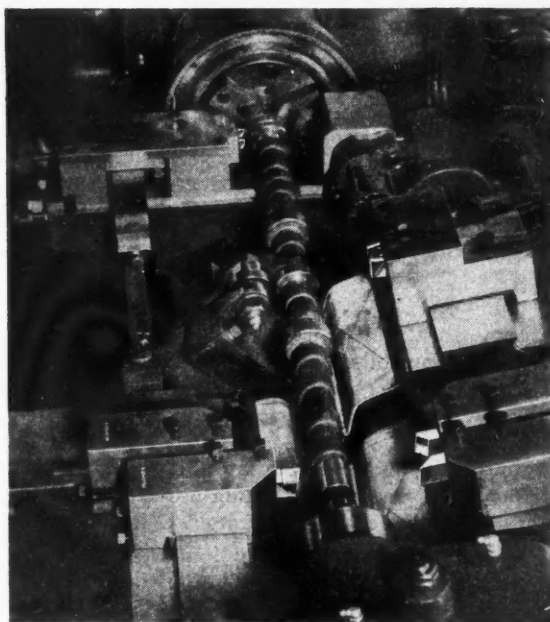
Illustration at the right shows a Lo-swing Lathe tooled for a secondary operation and equipped with a 2-speed head and automatic control. This arrangement provides the high speeds necessary for finish turning and squaring operations with cemented carbide tools and the low speeds required for an eccentric grooving operation. The lathe automatically shifts from high to low speed and the cam roller on the double eccentric grooving attachment is automatically withdrawn from the cam path during the high speed portion of the cycle.

Another interesting feature of this machine is the 2-slide carriage which accomplishes both roughing and finishing cuts on the small bearing. The roughing tool on the front slide relieves from the work before the tool on the second slide moves in for the finish cut.

Lo-swing engineers are anxious to help you with your camshaft turning problems and will be glad to prepare tool layouts and submit complete data.

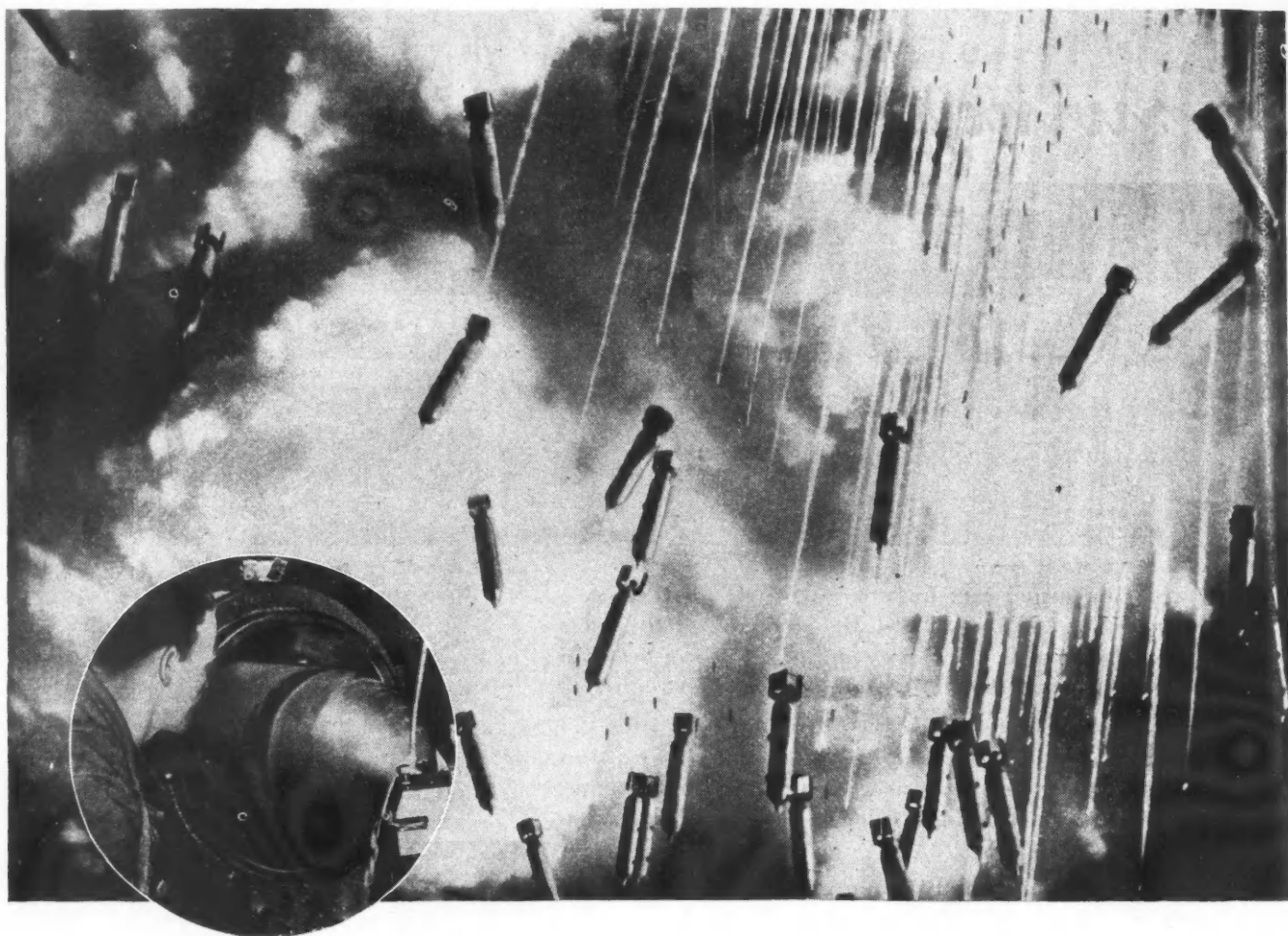
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

Removing approximately 1/16" of material from the sides of cams and on radius of line bearings of a forged camshaft; slide No. 1 (nearest tailstock) feeds in first; slide No. 2 follows 3/32" late to allow No. 1 slide to start backing out before No. 2 enters the cut on the line bearing. Slides No. 3 and 4 are likewise timed 3/32" late in their movements.



Lo-swing Lathe equipped with a standard two-slide carriage, two back squaring attachments, front steady rest, double eccentric grooving attachment and automatic two-speed head. Operations: cutting a double eccentric oil groove on the head bearing, rough and finish turning and chamfering the small end bearing, and facing and chamfering oil pump drive gear.

LATHE NEWS *from* SENECA FALLS



STEPPING UP OUTPUT

THE stepped-up tempo of the attack on all fronts steps up the need for ever greater output of certain weapons of war.

In turning out war goods at unprecedented rate, America is making use of several modern cutting coolants developed by Texaco.

Texaco Cutting Oils permit higher speeds and feeds, with improved surface finish. They lubricate the tools, and by carrying away the heat prevent chip welding and lengthen tool life, assuring greater output.

Another interesting use of *Texaco Cutting Oil* is the removal of burrs

from small aluminum stampings—formerly a laborious hand operation. A Texaco Engineer discovered that putting the stampings into tumbling barrels with *Texaco ALMAG Cutting Oil* increased output 20 times.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed in the panel.

The services of a Texaco Engineer specializing in cutting coolants are available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

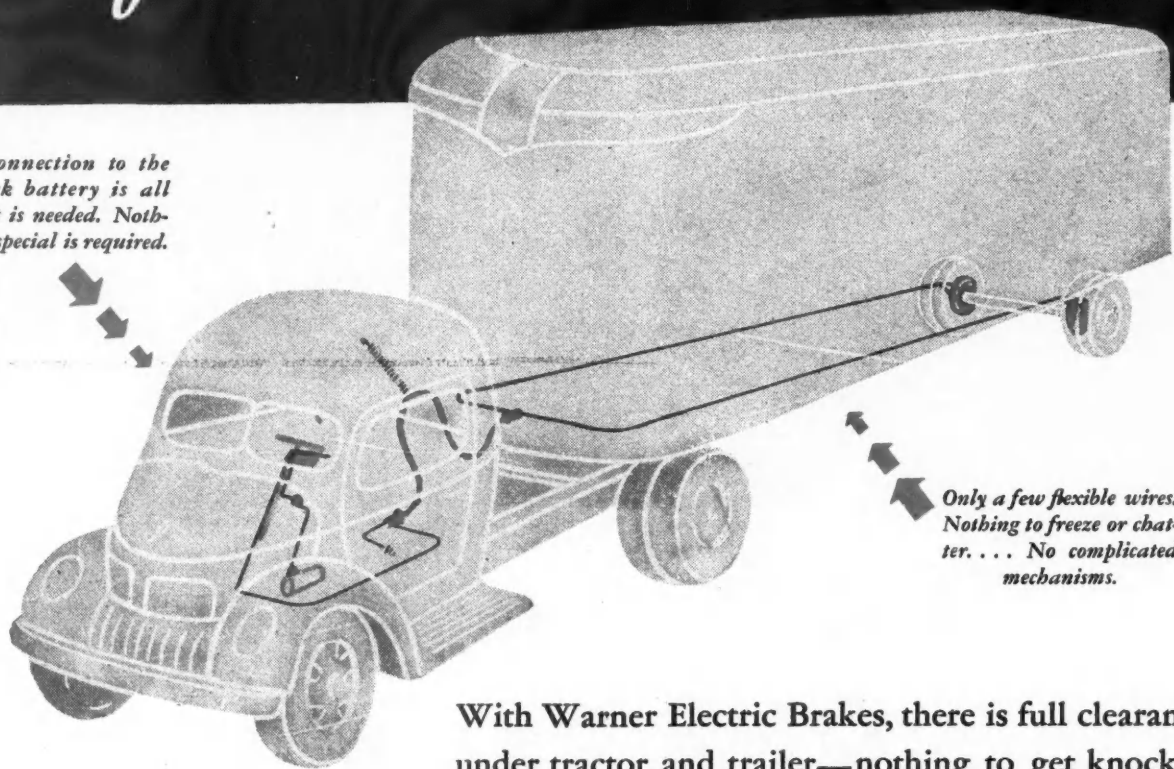


TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

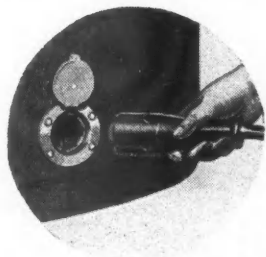
NO OTHER BRAKE EQUALS THE WARNER ELECTRIC BRAKE *for* SIMPLICITY

A connection to the truck battery is all that is needed. Nothing special is required.



Only a few flexible wires. Nothing to freeze or chatter. . . . No complicated mechanisms.

PLUGS IN AND OUT LIKE A RADIO



The plug-in cable provides current for brakes, tail light, stop light and running lights.

Right now, the needs of our armed forces come first! However, if you are on the "essential" list we can supply you with brakes.



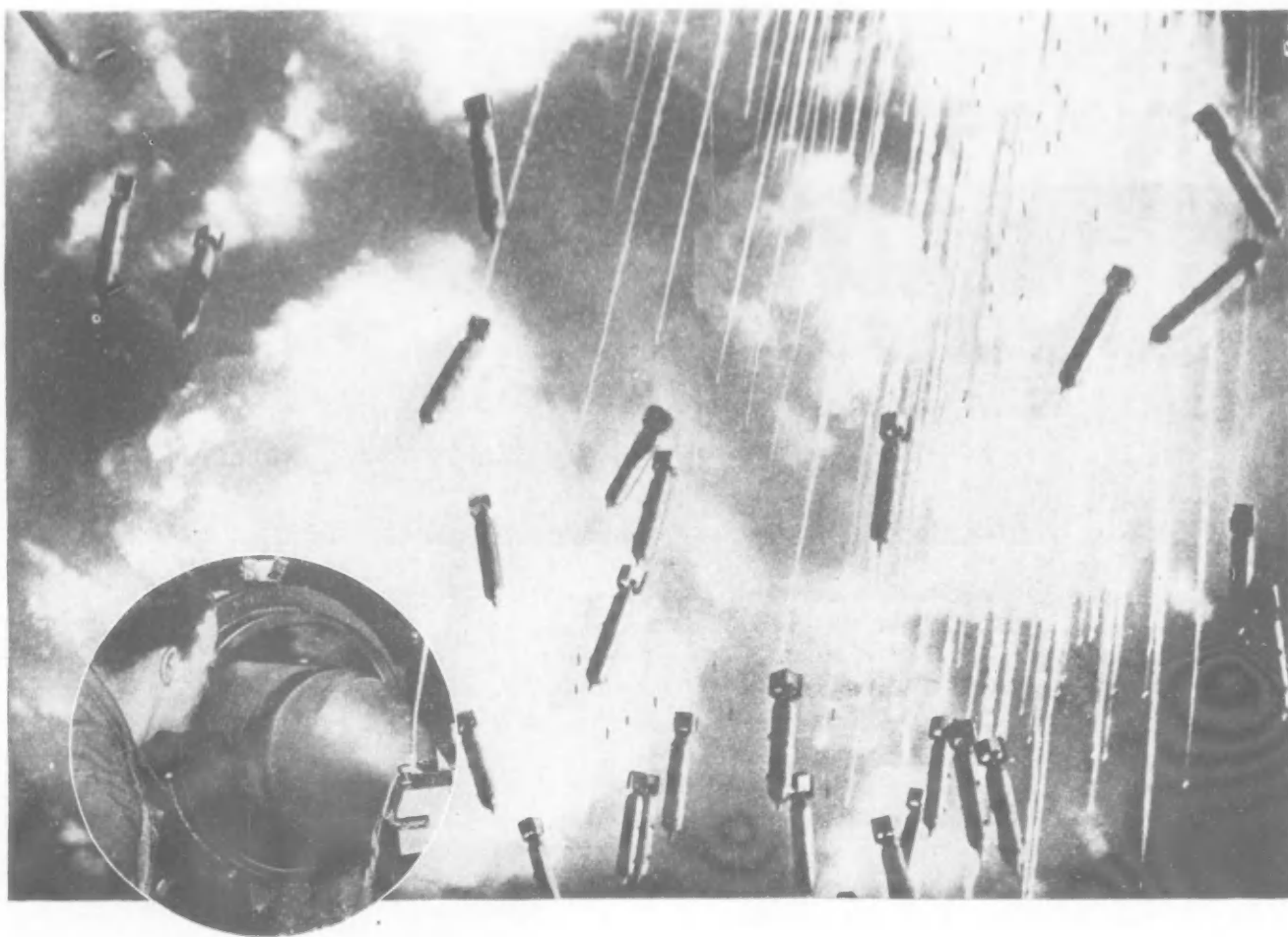
With Warner Electric Brakes, there is full clearance under tractor and trailer—nothing to get knocked off or leak — no exposed braking equipment — no rods to rattle—no tubing to split—no condensation to freeze. Warner Electric Brakes require only a wire to each wheel and will operate under water without short circuiting. Minimum maintenance cost.

WARNER ELECTRIC BRAKES

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY • BELOIT, WISCONSIN

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES



STEPPING UP OUTPUT

THE stepped-up tempo of the attack on all fronts steps up the need for ever greater output of certain weapons of war.

In turning out war goods at unprecedented rate, America is making use of several modern cutting coolants developed by Texaco.

Texaco Cutting Oils permit higher speeds and feeds, with improved surface finish. They lubricate the tools, and by carrying away the heat prevent chip welding and lengthen tool life, assuring greater output.

Another interesting use of *Texaco Cutting Oil* is the removal of burrs

from small aluminum stampings—formerly a laborious hand operation. A Texaco Engineer discovered that putting the stampings into tumbling barrels with *Texaco ALMAG Cutting Oil* increased output 20 times.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed in the panel.

The services of a Texaco Engineer specializing in cutting coolants are available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

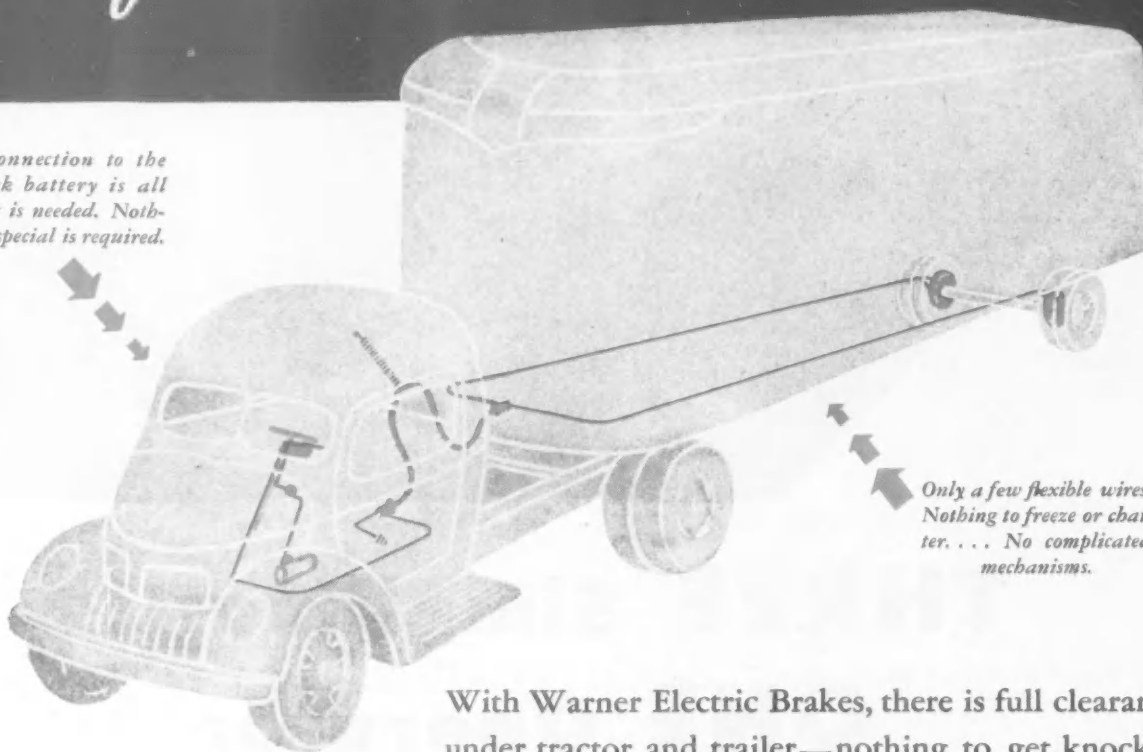


TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

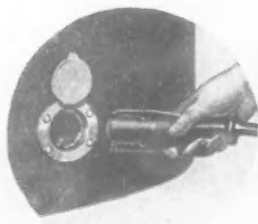
NO OTHER BRAKE EQUALS THE WARNER ELECTRIC BRAKE *for* SIMPLICITY

A connection to the truck battery is all that is needed. Nothing special is required.



Only a few flexible wires. Nothing to freeze or chatter. . . . No complicated mechanisms.

PLUGS IN AND OUT LIKE A RADIO



The plug-in cable provides current for brakes, tail light, stop light and running lights.

Right now, the needs of our armed forces come first! However, if you are on the "essential" list we can supply you with brakes.



With Warner Electric Brakes, there is full clearance under tractor and trailer—nothing to get knocked off or leak—no exposed braking equipment—no rods to rattle—no tubing to split—no condensation to freeze. Warner Electric Brakes require only a wire to each wheel and will operate under water without short circuiting. Minimum maintenance cost.

WARNER ELECTRIC BRAKES

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY • BELOIT, WISCONSIN

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

7



THREE Simplimatics ONE Operator

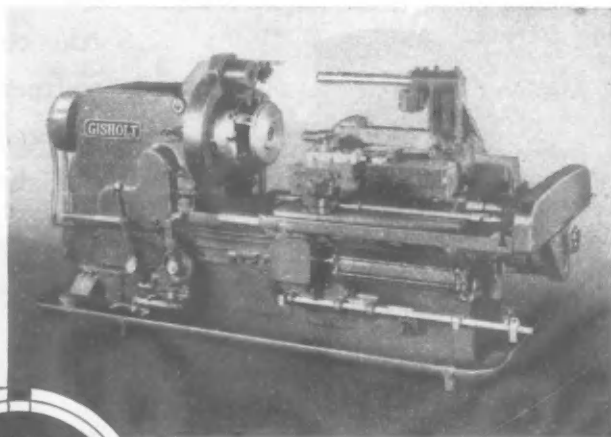
THIS is typical of what you'll see wherever Gisholt Simplimatics enter the production picture . . . an amazing volume of machining work, done swiftly and easily.

That's the story of the Simplimatic in a nutshell—a completely automatic cycle of machining operations set in motion with one simple control. That's what makes it possible for one person (with very little training) to tend several machines.

In today's war production, Gisholt Simplimatics are doing much to relieve the shortage of skilled hands. If you have parts to machine in large quantities, investigate them now.

GISHOLT MACHINE COMPANY
1205 East Washington Ave., Madison, Wisconsin

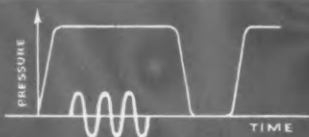
Look Ahead—Keep Ahead—With Gisholt



GISHOLT SIMPLIMATICS are built in both Platen and Radial types. Both permit multiple cutting with accuracy at high cutting speeds. Write for complete information about them.



TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES



**high welding pressure-
precise welding current**



**200 spot welds per
minute**

**... mean high quality, high production
welding on light gauge ferrous alloys.**

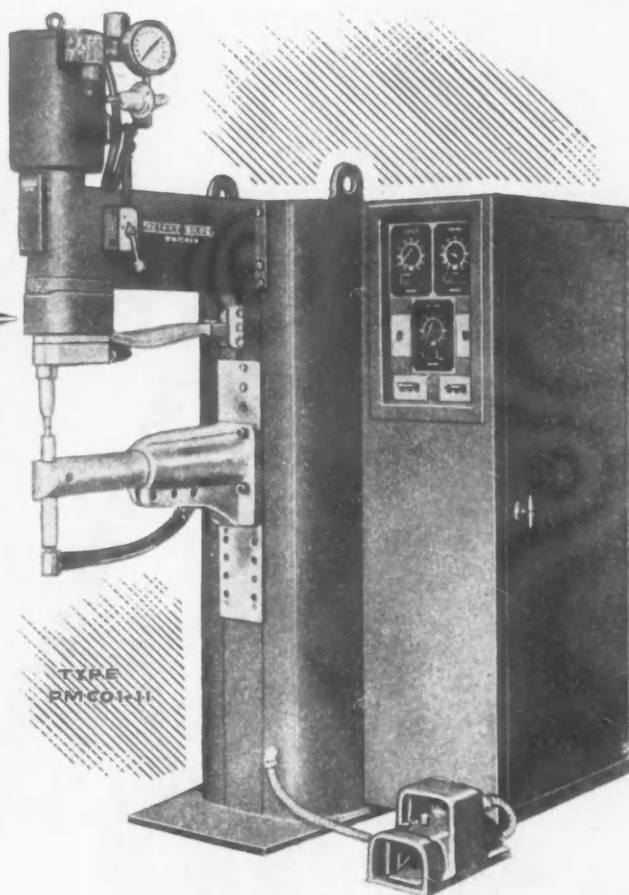
This 60 KVA Sciaky Spot Welder is specifically designed for the high quality welding of stainless steels, mild and zinc-coated steels, monel metals, brass and copper. The high pressure (up to 2600 lbs. psi) and electronic current timing assure high shear values wherever structures are subject to stresses and vibration.

Note these additional exclusive Sciaky features.

SELF-CONTAINED UNIT . . . Electronic controls and ignitron contactor are mounted in a hinged cabinet convenient to operator . . . simplifies installation.

SCIAKY ELECTRONIC TIMER . . . The patented Sciaky Timer uses no intermediate relay, but operates a heavy duty relay direct from the tube.

TRANSFORMER . . . Secondaries are hard rolled copper — having less tendency to overheat than cast.



HEAD RETRACTION . . . Retraction of 2¼" is controlled by foot switch. Short working stroke (½") eliminates tendency of electrodes to hammer.

SCIAKY ELECTRO VALVE . . . Air to the operating cylinder is controlled by a specially designed, fast-acting d.c. operated solenoid valve.

FLEXIBLE BRAIDED CABLES . . . These are used between the transformer and upper electrode and result in less tendency for fatigue breaks.

FOOT SWITCH . . . Stroke on hooded foot switch is ¼"—operator need not raise entire foot from floor.

AUTOMATIC WATER SHUT-OFF . . . Water supply to electrodes is cut off when head is retracted or control switch off—means quicker electrode change.

SCIAKY BROS.

Manufacturers of a Complete Line of A-C and D-C Electric Resistance Welding Machines
4915 W. 67th STREET, CHICAGO, ILLINOIS

Sciaky specializes in the design and construction of special equipment. Consult us on your resistance welding problems.

PACKAGES OF POWER

Foote Bros. Actuators are used on the Lockheed Lightning P-38



Foote Bros. Actuators are used on the Lockheed Constellation C-69



Foote Bros. Actuators are used on the Lockheed 349



FOOTE BROS. ACTUATORS DO THE HEAVY MECHANICAL JOBS

As airplanes have increased in complexity, the job of the pilot has become more and more difficult. To free him of some of the heavy mechanical jobs, actuators have been developed which are, in effect, packages of power that perform many such jobs as opening and closing ventilators, operating wing flaps, retracting under-carriages and setting stabilizers.

These actuators are compact motor-driven gear units and their proved practicability on airplanes now flying points the way to greater use on planes now on drafting boards.

Because of the vast technical experience and manufacturing "know hows" acquired in producing high precision gears for the aircraft industry, Foote Bros. has also been called upon to engineer and manufacture actuators for many applications.

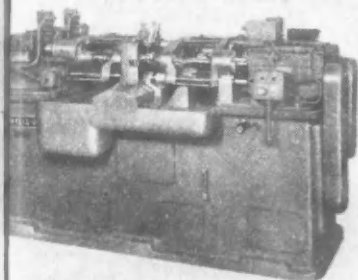
If you are contemplating using these packages of power on models you are now producing or are designing, our engineering department may be able to aid you in developing actuators to meet your specific needs.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois

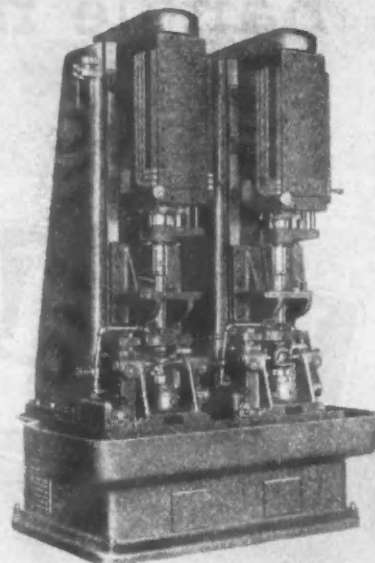
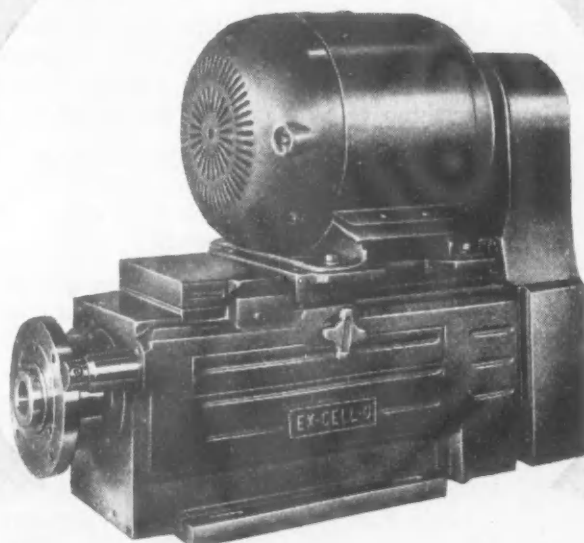
FOOTE BROS.
Better Power Transmission Through Better Gears

XLO

EX-CELL-O for PRECISION



Here is shown an instance where the Ex-Cell-O Small Hydraulic Unit (Style 21) is used on a machine for the accurate drilling of holes in oil pump bodies.



On this Ex-Cell-O double drill press, two Style 25-A Ex-Cell-O Hydraulic Units are mounted on the columns in vertical position. This has definite advantages on certain classes of work.

Plan Now for ECONOMICAL PRODUCTION!

**Production Machines
equipped with Ex-Cell-O
Hydraulic Units have
numerous advantages**

Where high production,
accuracy, and economy
through multiple opera-
tions are required—
consult EX-CELL-O now

For the machine you build, or the machine we build, the use of Ex-Cell-O Hydraulic Power Units provides these features:

- They are compact, for proper design.**
- They are self-contained, for ease in installation.**
- They have infinite feeds, for proper cutting.**
- They have gear change, for proper speeds.**
- They have ample power, for multiple-head operation.**
- They have variable stroke, for greater flexibility.**

Ex-Cell-O Hydraulic Power Units are standard and produced in quantities, but in nearly every case where the unit is used it becomes a part of a special, high production type machine for a specific operation. These units are economical because, as applications change, the units can become a part of the new machine even though entire base is redesigned.

The units can be mounted on any plane—horizontally, vertically, or angularly—on a temporary or a permanent base, and they can be arranged so that it is possible to use them in connection with guide bars and multiple drill heads.

Find out today how Ex-Cell-O Special Machines and Ex-Cell-O Hydraulic Power Units can fit your program for today's and tomorrow's production.

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES BROACHES • HYDRAULIC POWER UNITS • GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PURE-PAK CONTAINER MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

handle more with fewer hands...


Now, when manpower shortages are so serious, you can get more done with fewer people by using P&H Hevi-Lift Hoists. For with these modern electric hoists — carrying, lifting, lowering and placing are reduced to the simple pushing of buttons. And they're all done *without* rehandling.

Hevi-Lifts bring many other equally important benefits. They conserve workmen's energy, allowing them to work more efficiently throughout the day... they speed up materials handling... lower production costs... and they eliminate aisle congestion.

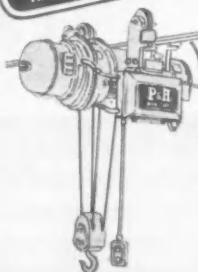
Lowered materials handling costs, alone, pay for Hevi-Lifts in a short time. They are your answer for faster, lower-cost production today — and tomorrow. A P&H Hoist Engineer will be glad to talk over your requirements. In any case, send for information.



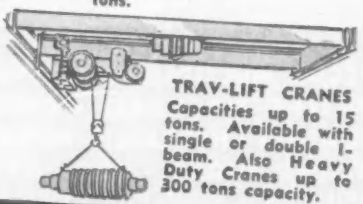
ZIP-LIFT HOISTS
Capacities up to 2,000 pounds.



HEVI-LIFT HOISTS
Capacities up to 15 tons.



TRAY-LIFT CRANES
Capacities up to 15 tons. Available with single or double I-beam. Also Heavy Duty Cranes up to 300 tons capacity.



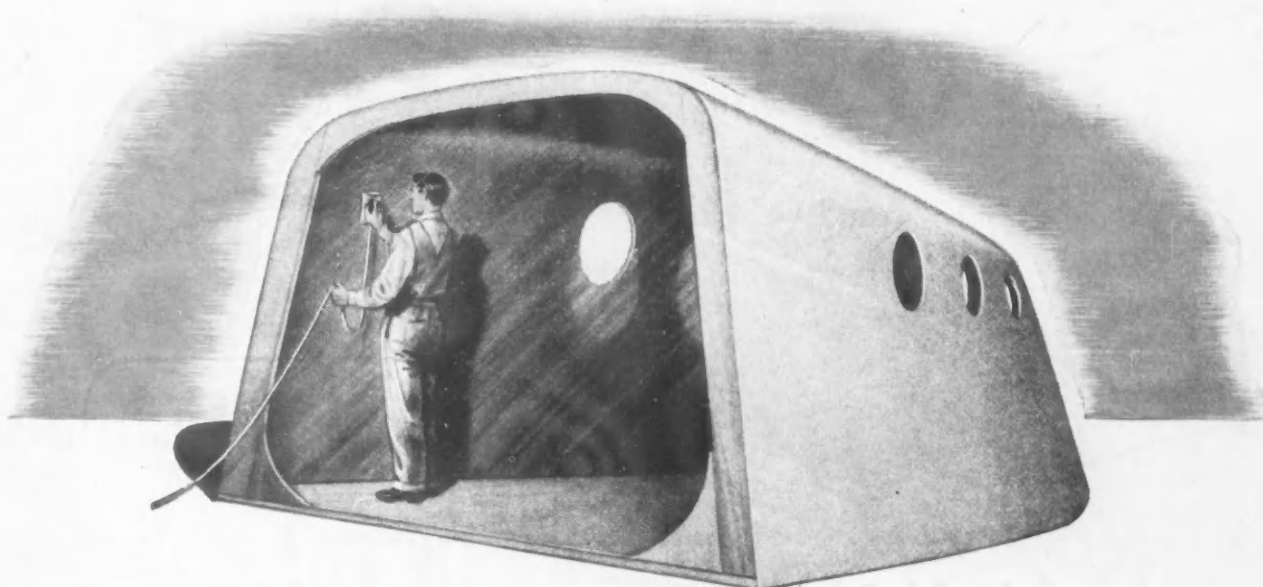
General Offices: 4559 W. National Ave., Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

HOISTS • WELDING ELECTRODES • MOTORS  EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

BAKELITE

TRADE MARK



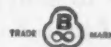
Deckhouses **NOW**... Station Wagons **TOMORROW?**

ONE-PIECE molded bodies for trucks and station wagons? Not only possible, but highly probable, in view of the rapid strides in the development of resin glues and the art of plywood molding, of which this is typical: When a large number of deckhouses had to be produced quickly, the Haskelite Manufacturing Company had the answer . . . a one-piece, molded plywood cabin to be made on a mass-production basis using BAKELITE Phenol Resin Glue.

This plywood glue is not to be confused with older types that permitted peeling and warping. It is fire-resistant, water-proof, fungus-proof—produces plywood that is light, strong, easily finished with stain, varnish, shellac, or paint. It is easily sprayed onto the laid-up veneers.

The aviation industry has quickly and successfully found—and is still finding—wide use for molded plywood . . . from small parts to large aircraft sections. Automobile men will do well to keep this versatile new material in the forefront of their postwar plans.

Bakelite Corporation is supplying glues to many leading manufacturers of molded plywood. We will gladly put you in touch with those best fitted to answer your questions and provide help with your problems. Please address Department 27.

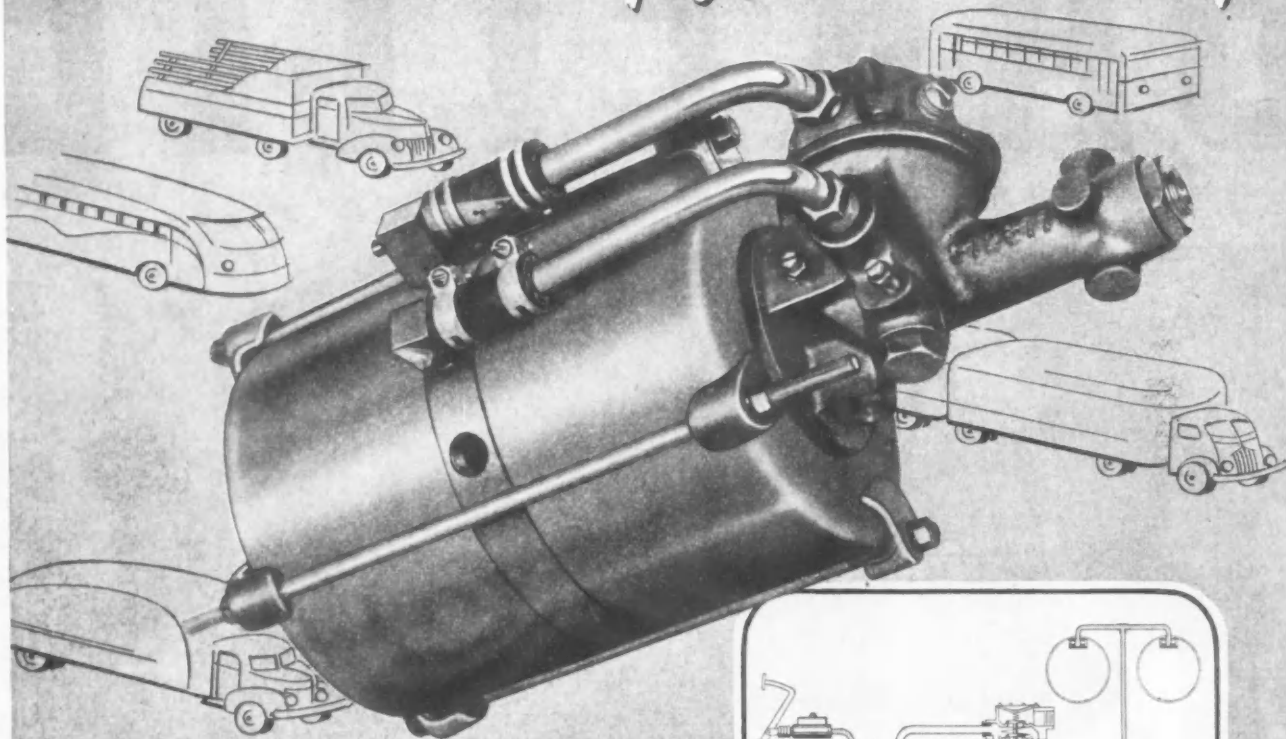


BAKELITE CORPORATION, 30 E. 42 St., New York 17
Unit of Union Carbide and Carbon Corporation



Resin Glues

FOR SIMPLER *Power Braking*

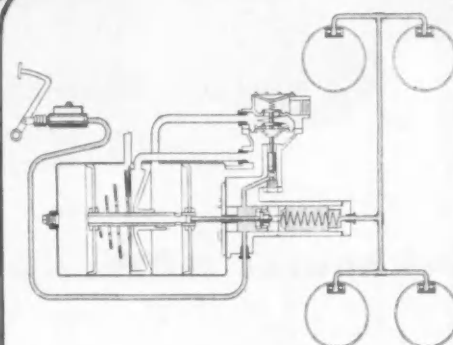


HYDROVAC*

The "One-Unit" System OFFERS MANY OUTSTANDING ADVANTAGES

The Hydrovac Vacuum Power Braking unit combines into *one* compact assembly a hydraulically actuated vacuum control valve, a tandem-piston power cylinder and a hydraulic cylinder. This simpler system brings a new standard of safety to heavy hauling and offers unequalled ease of installation either as original equipment or as a replacement. It is but one of many Bendix peacetime products which are being further improved while serving on military vehicles and which will be available for civilian transportation when peace is won.

*Trademark of Bendix Aviation Corporation



Physical effort on the brake pedal hydraulically actuates the valve which controls the vacuum power cylinder. The power cylinder acts upon the Hydrovac hydraulic cylinder, providing ample hydraulic power for full brake application.

- Simplified Installation
- No external levers or moving parts
- Can be located practically anywhere on vehicle
- The ideal combination of physical control and power braking
- Safer — physical actuation is unimpaired in the event the power system fails due to accidental damage

BENDIX PRODUCTS DIVISION OF BENDIX AVIATION CORPORATION • SOUTH BEND, INDIANA



AUTOMOTIVE and AVIATION INDUSTRIES

Volume 90

April 1, 1944

Number 7

Postwar Parts Distribution 17

Some day soon this war will be over and the car manufacturers are planning for a new and improved system of parts distribution for that day. Here is shown the situation as it is and what is being accomplished towards the days to come.

High Performance Fighters 22

Fighter design requirements demand performance of the highest order and by watching the developments in this class of plane, a forecast of the plane of tomorrow might be made. This article digs right down deep into the subject and points out many of the recent innovations that could easily have gone unnoticed.

Production of Exhaust Collector Rings 24

Not alone has the design of exhaust collector rings gone in for a lot of new features but the technique of their manufacture as well. Here is how the American Central Manufacturing Co. is doing it and what they have accomplished. It is liberally illustrated.

Military Truck Performance 32

Much has been done since Pearl Harbor in the development of trucks for the armed forces. Many of these improvements have a most direct bearing on the design of commercial vehicles that will take care of our transport problems tomorrow. In this article we get a report of their performance with comparative charts and illustrations.

New Hendy Series 50 Diesel 39

Here is a model with a wide range of modern design features for stationary and marine use. It is fully described and illustrated.

Forming Properties of Vulcanized Fiber Sheet 40

This article treats the forming of this material with a most enlightening completeness. It is written authoritatively with a background of experience in design and manufacturing technique.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Another Job for Mr. Baruch

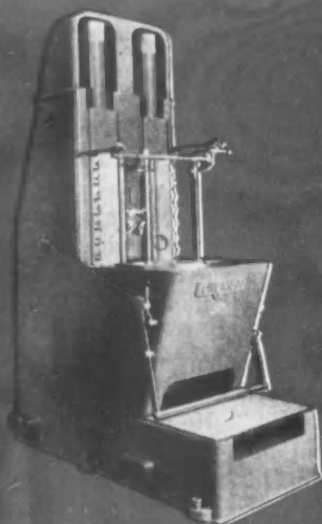
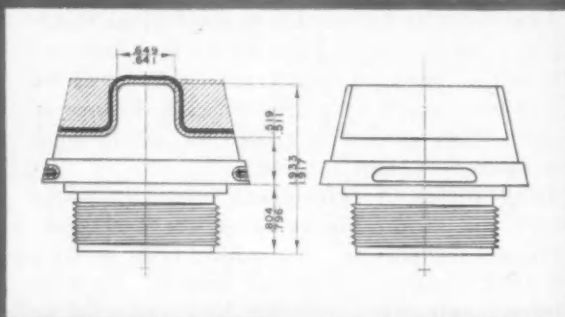
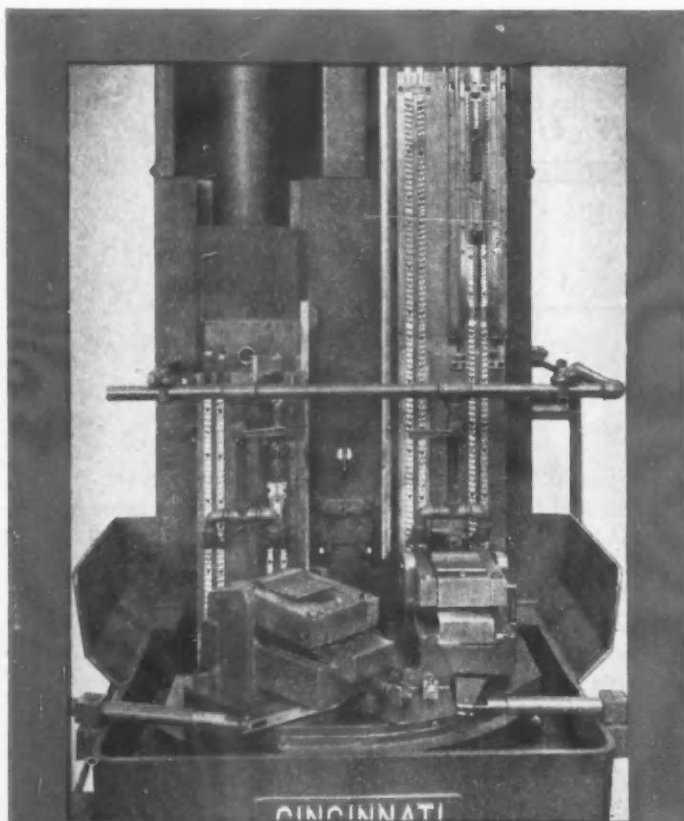
By Julian Chase

WITH respect to civilian motorized highway transportation there is an irresistible though, to some minds still, an inexplicably obscure trend toward doing something about it. What will eventually be done is something that must be done, although that vitally important fact does not seem to be recognized by as many as it should be. The laggards will sooner or later be enlightened.

Our essential automotive equipment is wearing out. The rate of deterioration is dangerously increasing. Frequent warnings of conditions now almost immediately threatening have been heard but not duly heeded over a long period. Now they are coming with augmented emphasis and from a greater number and variety of sources. We have, among the latest, a report of the Truman Committee to the United States Senate which points out that the situation is bad and is rapidly getting worse to the serious detriment of the country. With respect to passenger cars we are in a sad state. With respect to trucks we are in what may soon become a tragic condition.

Underlying forces of tremendous economic power are steadily and inexorably bringing about a condition of absolute compulsion. Something must be done soon and that something must be drastic. It must not be merely palliative. It must be curative as to the present and preventive as to the future. As the Truman Committee says, shortages of new equipment, replacement parts, tires and manpower will make difficult the doing of what must be done. But that's not the whole story by any means. The production of automobiles can not be started and stopped by simply turning a faucet on and off.

In spite of the difficulties, we must maintain our highway transportation in the highest possible state of efficiency to keep our war production program rolling and to keep our civilian economy functioning. Not long ago, the late Joseph B. Eastman, O.D.T. Director, said, "The economy of the country is now definitely geared to truck transportation and would collapse without its aid." He would undoubtedly have agreed to a substitution of the term motor vehicle, with its broader meaning, for the word truck. Who would not? The time to formulate and put into operation a definite and adequately comprehensive plan, something like the rubber program, to prevent that collapse, is now.



CINCINNATI No. 5-42 Duplex Hydro-Broach machine. Complete data may be obtained by writing for catalog M-894-2. A number of interesting case histories of CINCINNATI Hydro-Broach applications may be obtained by writing for folder M-1207.

DEEP-CUT BROACHING

Multiplies Depth of Cut by 4

Many new ideas for the machining of metals, tried and proven in the production of war material, must be considered in planning manufacturing methods for new products. Broaching machines, for example, ordinarily remove up to $5/32$ " stock, while greater amounts are within the fields of other machines.

Nevertheless, the ingenious tooling on the machine illustrated at left...a CINCINNATI No. 10-66 Vertical Duplex Hydro-Broach... makes it possible to remove $5/8$ " depth of stock and maintain a high rate of production at the same time.

Two parts are held in each fixture. The total depth of cut is obtained progressively by transferring the part from one side of the fixture, where it has been roughed, to the other side of the fixture, where it is finished. During the finishing cut two wrench slots are also broached. This arrangement produces one finished part each stroke of the ram (two parts per machine cycle).

Our engineers will be glad to apply their knowledge of broaching to your machining problems of today and tomorrow. Send blue print of part and full details with your request.



**THE CINCINNATI MILLING
MACHINE CO.**

CINCINNATI 9, OHIO, U. S. A.

Car Builders Plan Improvements in

Postwar Parts Distribution

SIZE of the postwar market for automotive replacement parts appears almost limitless, depending upon the degree of enthusiasm expressed by the individual queried on the subject. With the exception of approximately half a million cars sold under rationing, the newest car on the road today is at least 2 1/3 years old. This means they are prime customers for replacement parts even under wartime driving limitations.

According to the estimates of one large manufacturer, 13 per cent of the 23,552,549 passenger cars in service at the beginning of 1944 were under 2 1/2 years old. The largest number, 57 per cent, were 2 1/2 to 7 1/2 years of age, while 30 per cent were more than 7 1/2 years old. An interesting comparison can be made between these figures and the breakdown of total registrations on Jan. 1, 1942, just after Pearl Harbor, when the number of cars in service reached a record high of 26,465,321 passenger vehicles. As of that date, 32 per cent of the cars were less than 2 1/2 years old, 46 per cent were in the 2 1/2 to 7 1/2-year-old age group, while only 22 per cent were more than 7 1/2 years old.

With no new car production anticipated in 1944, the proportion of older cars will increase by Jan. 1, 1945. Registrations as of that date are estimated at 21,497,682 vehicles, of which a slim three per cent will be less than 2 1/2 years old, 58 per cent will be in the 2 1/2 to 7 1/2-year-old classification and 39 per cent will be more than 7 1/2 years old. Even granting the limited production of 2,000,000 passenger cars for essential civilian use in 1945, it is estimated that total registrations at the end of that year will decline to 21,258,729 units, the lowest since Jan. 1, 1935. Of the cars still in service Jan. 1, 1946, it is estimated that nine per cent will be less than 2 1/2 years old, 49 per cent will be 2 1/2 to 7 1/2 years of age and 42 per cent will be more than 7 1/2 years old.

Although it is estimated that the number of pas-

senger cars in use will drop by more than 5,000,000 vehicles between Jan. 1, 1942, and Jan. 1, 1946, the replacement parts market still is attaining record levels because owners have no choice but to keep their old cars in operation if they want motor transportation. With a 5,000,000-car deficit to make up, it probably will be late in 1948 or 1949 before total registrations again reach the level of Jan. 1, 1942. Sales of repair parts and accessories for civilian vehicles reached a record total of \$718,212,295 in 1941, according to estimates of the Automobile Manufacturers Association, based on Federal excise tax receipts. The total dropped sharply by 34 per cent to \$471,956,981 in

1942 as war-imposed Government regulations and material shortages curtailed output of all but the most important functional parts. With manufacture of non-functional parts still forbidden in 1943, parts sales climbed to \$525,000,000, according to preliminary estimates.

By

E. L. Warner, Jr.

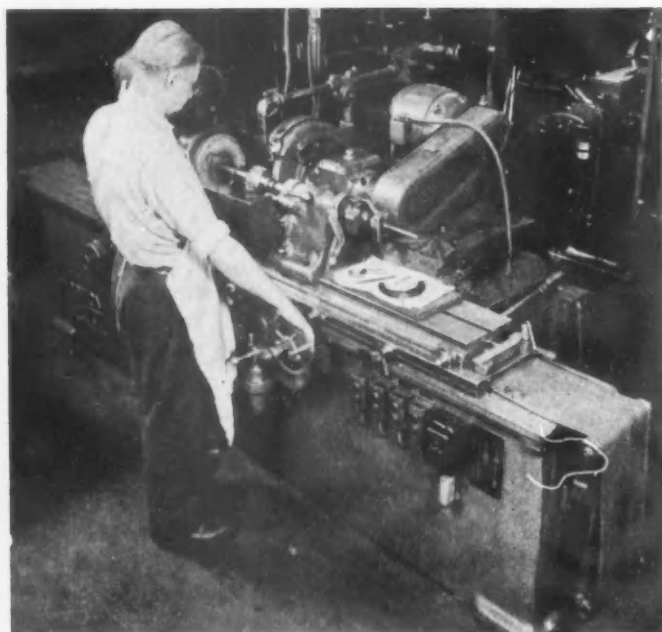
Confronted with a constantly expanding replacement parts demand, what are the automobile manufacturers doing to insure their full participation in this lucrative postwar market? The major manufacturers, with one possible exception, plan to follow the general pattern of their prewar parts distribution through factory warehouses and their own authorized dealers. Some alterations may be made in the physical set-up to insure faster delivery or better service for the dealers, but the general scheme of distribution is expected to remain in "status quo."

The one possible exception is General Motors Corp., which has had under consideration a plan to sell GM replacement parts through selected jobbers as well as to its own 15,000 dealers. There are several factors to be weighed in a move such as GM is contemplating. GM has, for example, to consider the attitude of its own dealers if it sells GM-made parts to jobbers, who in turn would sell to the independent repair shops

(Turn to page 128, please)

Morse Chain Production Quickly Adapted to War

By Joseph Geschelin



ment is further tribute to the flexibility of the organization.

The backbone of productive equipment in this plant is found in a battery of some 12 Bullard Mult-Au-Matics of six- and eight-spindle types; and a large battery of Cone Automatics. A specialized knowledge of the potentialities of these machines and the ability to take advantage of their versatility has made it possible for Morse Chain to undertake the manufacture of many items foreign to its normal business. Most external gear cutting is done by hobbing in two stages—first operation, roughing; second operation, finishing. The gamut of internal gear cutting and the formation of special cams and

AN EXCELLENT example of flexibility not only of production facilities, but in management thinking as well, is found in the Detroit plant of Morse Chain Co., division of Borg-Warner Corp. In normal times this plant is known for its ability to produce sprockets and gears, flexible couplings, free-wheeling clutches, and speed reducers in large volume. During the war the company turned its facilities to the manufacture of many specialized parts and assemblies for automotive, aviation, and marine application oftentimes foreign to its usual experience. The fact that products for the war were undertaken without plant expansion and without adding new equip-

(Above) One of the new 16 by 48 in. Norton grinders used for finish-grinding gear and shaft diameters.

(Right) Fellows gear shapers of several types and sizes constitute an important part of the equipment in this plant. The machine at the left is cutting an internal gear while the one at the right is cutting external gear teeth.



Facilities Products

*This is the Ninety-second
in the series of monthly
production features*

shapes is handled on a battery of Fellows gear shapers.

In addition to the foregoing there are drill presses, multiple-spindle drills, W & S turret lathes, LaPointe hydraulic broaching machines, and a variety of other more or less conventional machinery.

It is of interest to note that Carbide-tipped tools are used extensively on the Bullards for all metal removal operations on cast iron parts. Needless to say, this has resulted in a tremendous improvement in the productivity of these machines. One operation in particular—the drilling of a hole in one of the cast iron parts, using a Carbide-tipped stepped drill—is said to be the fastest Bullard job

(Right) Prize exhibit of mass-production is this four-ram LaPointe hydraulic broaching machine. It cuts keyways in four gears—simultaneously—and on the down stroke stamps the timing mark location.

(Below) Part of a large battery of Bullard six- and eight-spindle Mult-Au-Matics found in the Morse Chain plant. Second machine from the left is an Ex-Cell-O boring machine used for boring certain blanks. Several heavy duty Baker drills are used for the same purpose.

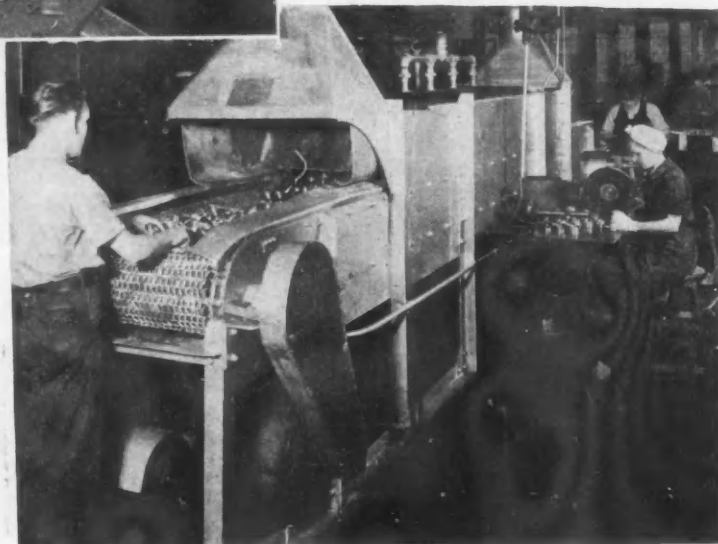




(Top) Heald internal grinders such as this Size-matic are widely employed for the finish grinding of bores in gears and other parts.

(Above) View in aircraft parts department emphasizing a group of LeBlond lathes used for finishing aircraft engine studs. These machines do a remarkable job of fast metal removal in heavy cuts, using cemented-carbide tools.

(Right) Parts are washed after machining operations in Detrex washing machines such as the one illustrated above.



known to the art. The use of Kennametal and Firthite tools on the turning of long studs or shafts has made possible the removal of alloy steel in fast, heavy cuts, speeding the operation many times.

Skilled production management and flexibility of thinking are reflected at every turn in the effective use of available equipment and in the development of many tricks of the art. Here, for example, is a small hydraulic broaching machine built by LaPointe. It has four rams and is so arranged as to cut keyways in four gears at a time. Moreover, the cycle also includes the stamping of the timing mark on the down stroke. Another major development is the adoption of flame hardening for the heat treatment of internal gears. This takes the place of a costly and lengthy procedure formerly employed.

Perhaps the best way to visualize the methods employed in this plant is to consider the manufacture of some typical parts. Take as an example the coupling flange for a Morflex coupling. This comes in as a steel forging which is machined completely in a six-spindle Bullard Mult-Au-Matic. The two flange holes are drilled, counterbored, countersunk, and tapped. Major improvement in method is the drilling, counterboring, and countersinking of the flange holes in one operation, using step drills especially formed for this operation. Previously the job was done in four separate steps.

A sprocket hub, made of a semi-steel casting, is another

example of improved processing. Originally this piece was tooled on two separate Bullards—one for each end. Now the job is produced on a single eight-spindle Mult-Au-Matic with double-indexing. One operator takes care of the machine, the loading and unloading being facilitated by means of mechanically-operated fixtures controlled by a foot trip motion. The keyway through the hub is broached in a horizontal double-ram LaPointe machine with three pieces on each of the two fixtures. The three flange holes are drilled, countersunk, and tapped in a special automatic Rockford drilling machine designed for this particular operation.

A chemical shell adapter marks the utilization of other specialized techniques. They are turned from cold-rolled steel bars in four-spindle $3\frac{1}{2}$ in. Cone Automatics. The fussy part of the job lies in the development of an extremely smooth and dense finish of the bored hole. This is done by "bearingizing" with a special tool in a Delta drill press. The tool consists of a series of rollers in a cage so arranged that the rollers bump over a series of high spots on the arbor, producing a hammering effect on the surface of the bore.

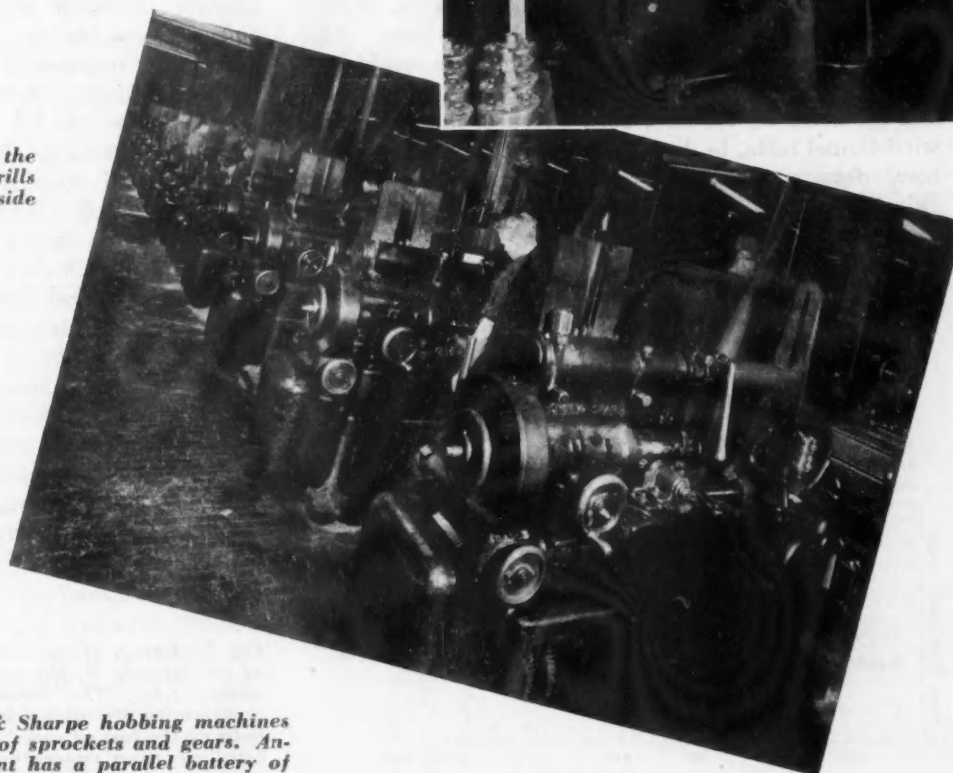
As mentioned earlier, one of the most outstanding developments is the adoption of flame hardening which has made possible an entirely new machining technique. Originally the alloy steel forging was hardened and tempered to 300 Brinell; turned in two operations on turret lathes; then drilled, ground, and the teeth cut in a Fellows gear shaper.

(Turn to page 76, please)



(Top) Close-up of battery of the familiar Delta bench-type drills tooled for "bearingizing" the inside diameter of shell adapters.

(Center) Intimate view of the special flame hardening machine developed for hardening the internal gear section of the parts shown in the foreground. A feature of this machine is the use of natural gas which is compressed in a Selas compressor unit mounted on a platform to the rear of the machine.



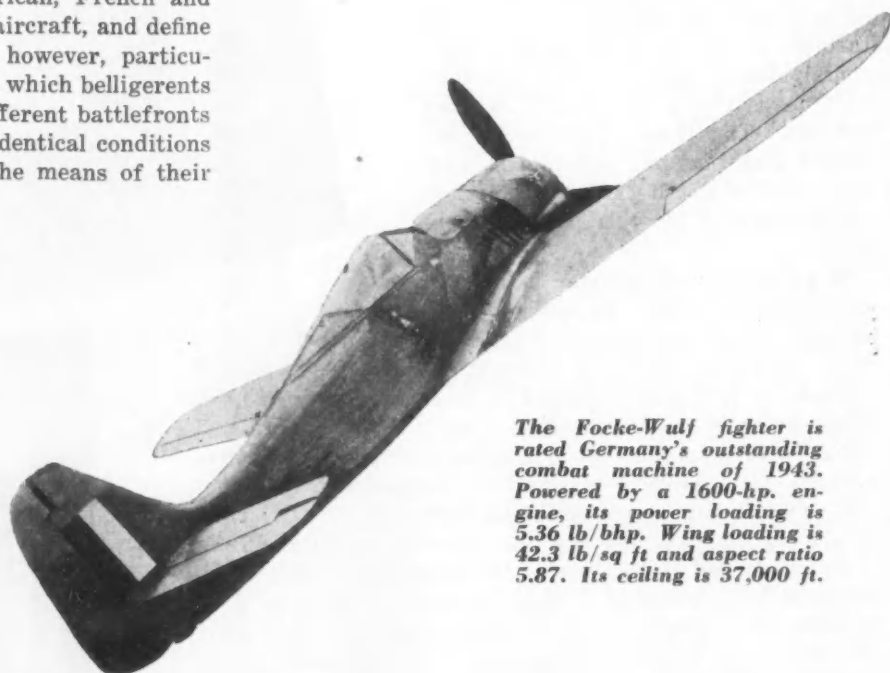
(Right) Long row of Brown & Sharpe hobbing machines used for cutting various types of sprockets and gears. Another section of the department has a parallel battery of Barber-Colman hobbers.

High

IN ALL highly-armed countries, the present-day trends of aeronautical development are becoming increasingly directed towards the same objectives. Only a few years ago, anyone in the slightest degree interested in aeronautics could immediately recognize and distinguish German, British, American, French and Russian civil and military types of aircraft, and define their characteristics. Since then, however, particularly as a consequence of the War, in which belligerents measuring their strength on the different battlefronts have found themselves faced with identical conditions and requirements, objectives and the means of their attainment are becoming increasingly similar.

It is at the present time quite inconceivable that types developed for the same purpose should differ as much as 20 per cent in speed; or that bomb loads, ranges, ceilings and equipment should show the wide range of variation which was formerly so common. Nowadays, quite small details ensure the superiority of any design over its corresponding "opposition" type, superiority being achieved at the cost of far more scientific and engineering effort and in the face of far greater difficulties, than even in the near past. At the time, such a development as the NACA cowling for radial engines, giving a gain of about 5/6 in head drag over the naked engine, could be accepted gratefully, but without enthusiasm. At the present day, even a fraction of this gain would be hailed with delight. It will be remembered, what long and intensive efforts have been pursued, in numerous wind-tunnel tests, to discover the laminar profile; and how, despite the exhaustive theoretical knowledge gained, practical progress has been slow, and the expected advantages mainly illusory.

Fighter design requirements call for performance of



The Focke-Wulf fighter is rated Germany's outstanding combat machine of 1943. Powered by a 1600-hp. engine, its power loading is 5.36 lb/bhp. Wing loading is 42.3 lb/sq ft and aspect ratio 5.87. Its ceiling is 37,000 ft.

the highest order—maximum horizontal speed at any altitude, maximum rate of climb and ceiling, maneuverability and diving power, combined in the smallest and lightest airframe possible. Modern bombers with supercharged engines attain heights calling for a corresponding increase in the rate of climb of the intercepting fighters. Current tactics in combat between fighters also call for superiority in altitude before opening the attack. Furthermore, the tactical situation frequently requires the fighters to operate at or near their rated ceiling, where superiority in horizontal flight is no longer decisive, and must be accompanied by a high rate of climb and maneuverability.

If these requirements are taken into account, the essential features in the further development of fighter designs become modified. In addition to measures for increasing the high-altitude performance of the power-unit, the design of the airframe must be based essentially on a regular theory of "high-altitude aerodynamics," giving proper consideration to the factors of weight and wing loading, etc., which

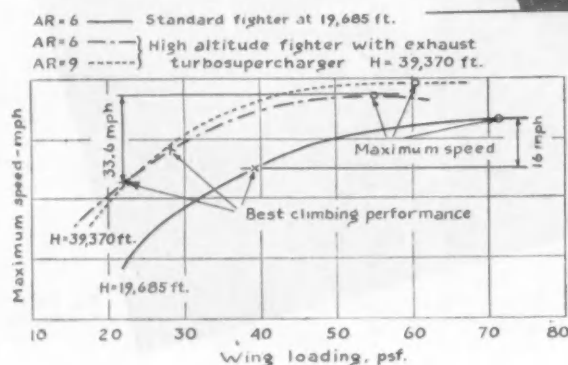


Fig. 1—Curves of airspeed wing loading with the parameter of the altitude H , the optimum values being indicated by small circles. The crosses, transferred from Fig. 2 and representing the wing loadings for optimum rate of climb, indicate the loss of speed (16.8 and 33.6 mph, respectively) resulting from concentration of the design on maximum rate of climb with the same engine power.

Performance Fighters

Design Problems at Stratospheric Altitudes Discussed in Luftwissen Article by German Aeronautical Engineer and Designer of Focke- Wulf FW 190 Fighter

By Kurt Tank

begin to predominate at great heights. It will not always be possible, however, to combine these requisites of high horizontal speed, rate of climb and ceiling, in a single fighter at all heights. The universal, high-performance type to which modern fighter design is tending, therefore becomes divided into two variants, differing in type of power unit (e.g. supercharger equipment), wing loading and aspect ratio, and design of propeller; and, as a sec-

ing and aspect ratio as will be explained presently.

It will be remembered that in modern high-speed aircraft, small fluctuations of flying weight do not have any measureable effect on the forward speed, since in any case low C_L (lift coefficient) values are used. Rate of climb and ceiling, on the other hand, are very sensitive to fluctuations in weight. Evaluation of accurate figures indicates that in any type of aircraft at high altitude, the attainable ceiling varies by about 213 ft. for every one per cent change in flying weight, while one per cent increase in engine performance increases the ceiling by only 140 ft. at 32,800 ft. altitude. Consequently, the added weight of devices for increasing the ceiling should not be allowed to exceed a figure at which the increased weight itself begins to affect the attainable ceiling. Since the relationship applies only for constant airframe dimensions, any

(Turn to page 56, please)

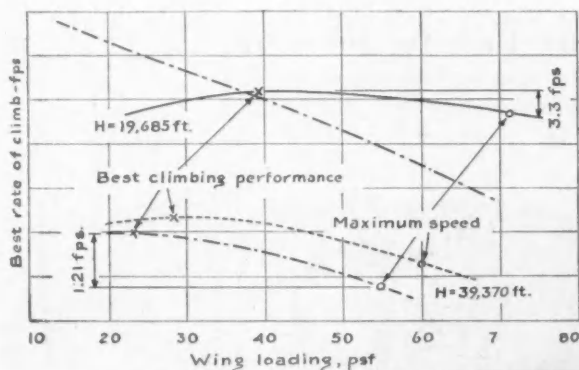
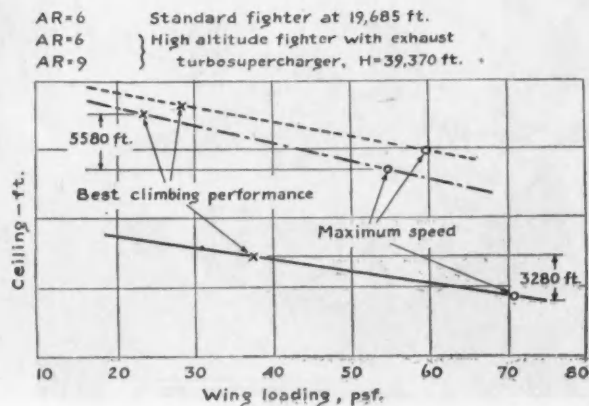


Fig. 2—Curves of best rate of climb against wing loading, giving the optimum rates of climb (small crosses) for lower wing loadings than designed for maximum speed, the points for which (small circles) are transferred from Fig. 1. The reduction in rate of climb for the "high-speed" design is given numerical values (3.3 and 12.1 fps respectively).

ondary development, also with different flying equipment, with the object of saving weight, while providing the pilot with the necessary facility of high-altitude flight.

The equipped weights of the parallel variants will differ in respect to the different superchargers, propellers, etc., fitted; the presence or absence of high-altitude equipment for the pilot (oxygen, pressure cabin), or for armament (anti-freeze devices); but most particularly by the weight of the wing unit, depending on unit load-

Fig. 3—Showing the falling ceiling with rising wing loading, the plotted points being the optimum values from Figs. 1 and 2. The gain in ceiling of "high-climb" compared with the "high speed" design, for the same engine output, is quite considerable (3280 and 5580 ft. respectively!)



Production Problems of

THE various departments of a company can often look back upon the problems of a new product with real amazement, after it is in production. "If we had known then what we know now—" the department heads will say. But in their voices will be the pride of good workmanship, of proven resourcefulness, of management trust and confidence. That's the way the American Central Manufacturing Corp. of Connersville, Ind., feels about the airplane engine collector rings it is building for Liberator bombers.

A collector ring is to an airplane what the exhaust pipe and muffler are to the automobile, PLUS. The exhaust manifold or collector ring on an airplane engine operates at extremely high temperatures. It must be light in weight, resistant to corrosion, adaptable to expansion and contraction, and so accurately designed and made that no exhaust gases will escape even though no packing or gaskets are used. The type of collector rings built at American Central combine the exhaust manifold and the feed duct to the turbo supercharger.

The collector rings fit a 14-cylinder Pratt & Whitney radial engine, and consist of ten major sections, each made of stainless steel stampings. In pre-war days before the mass production of airplanes, most collector rings were "tailor made" with the aid of power drop hammers, tem-

porary dies, and all-purpose equipment. Collector rings in quantity production were relatively new to everyone when American Central took them on. Few detailed drawings existed and blueprints were confined to general dimensions.

A visit to existing collector ring manufacturing sources was of some help, though they had been built, up to that time, by firms who specialized in their construction in small quantities. The big job was to adapt American Central's extensive mass production equipment for die-pressing and deep-drawing such pre-war articles as refrigerator cabinets, kitchen sinks and certain automobile body parts to the production of collector rings running into thousands of units.

The hundreds of thousands of welded steel parts

By Eric O. Johnson

Vice President and General Manager,
American Central Manufacturing Corp.

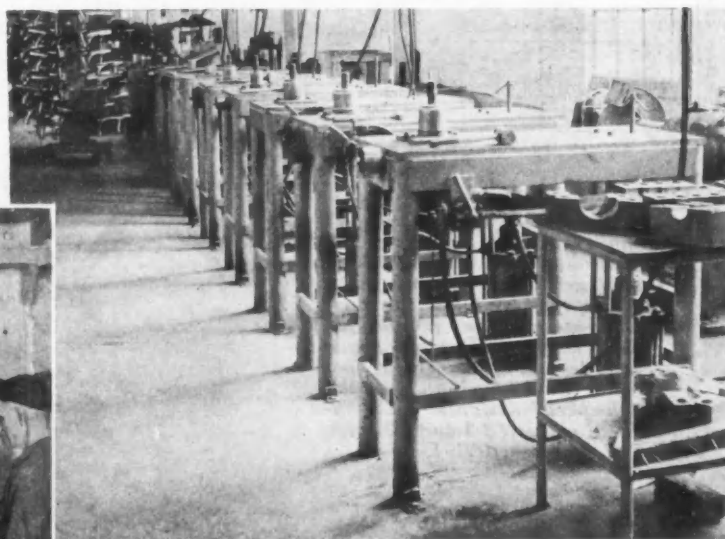
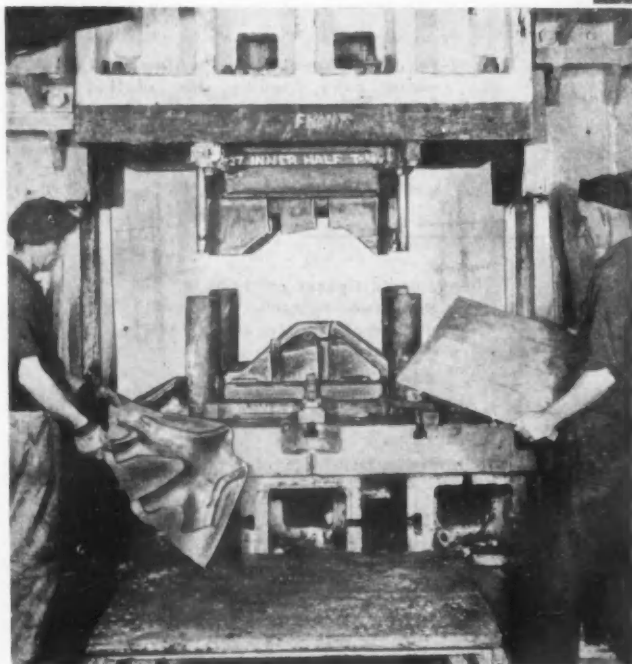


Fig. 2 (Above) Specially-built expanders, operated by compressed air, dilate the openings to correct size.

Fig. 1 (Left) Construction of dies for drawing the center section in only two pieces was a distinct innovation.

Exhaust Collector Rings

involved were required to be interchangeable with other parts produced not only by American Central but by other suppliers as well. To enter into such a program of production took courage on the part of the management and confidence in the organization's ability to adjust itself to this changeover. Heavy investment for equipment was involved. Additional personnel had to be drawn from unskilled and semi-skilled labor. Training problems were impressive, and so were the difficulties involved in priorities on materials and equipment.

In keeping with Government policy during the early days of the war production program, sample orders for collector rings were allotted to various companies and manufacturers were given a chance to prove their ability to produce. These trial orders were not large

enough to justify mass production tooling. Therefore, expenditures had to be based on management confidence in the airplane's part in ultimate victory. In anticipation of large quantity production, we at American Central undertook to provide the more complete equipment which such production required. Subsequent developments have more than justified that course of action.

There was a definite lack of complete information. The need for collector rings was so urgent that time did not permit the construction of models, master layouts, templates, assembly and detail drawings and other details ordinarily regarded as absolutely essential to a manufacturer located 2000 miles away from the customer. American Central's only recourse was to use a sample "hammered out" collector ring as a basis for their engineering, tooling and production program. From this sample and from such general drawings as were available, estimates for engineering time and cost, materials and time of availability, construction and design of tools, cost and delivery time for manufacturing equipment, personnel requirements and training and time of final fabrication were drawn by American Central department heads. From these estimates the contract was negotiated and the program begun.

Wood models of each major section of the "hammered out" sample unit were made to

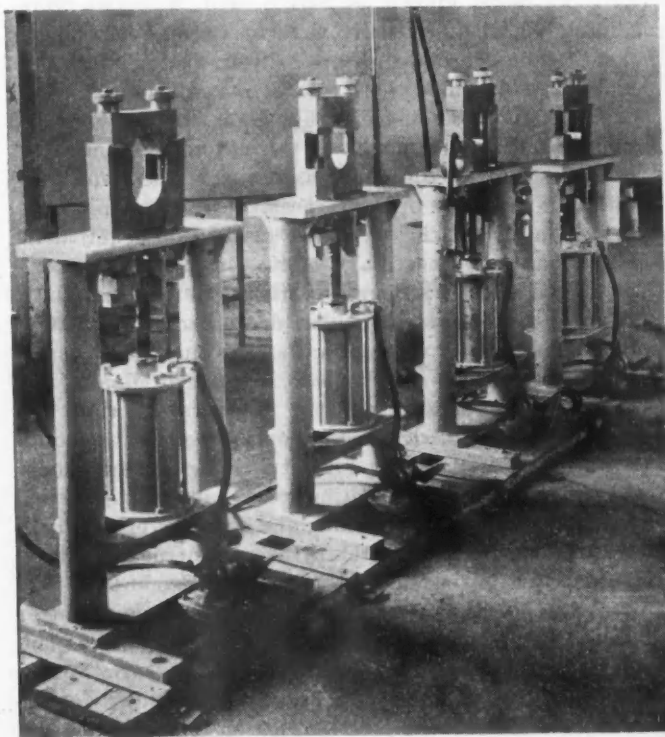


Fig. 3 (Above) Pneumatic swagers, equipped with hydraulic stops, were devised as another means of bringing collector ring tubes to proper dimensions.

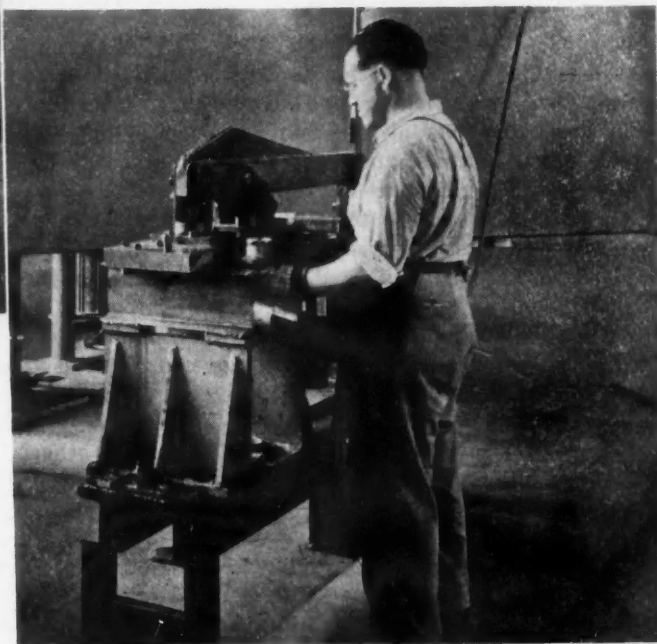


Fig. 4 (Right) This device, resembling an alligator-type riveter, was designed to flatten the bolting flanges at a single squeeze. It can apply up to 30,000 pounds pressure between its jaws.

Fig. 6 (Right) Girls have become expert at continuous seam welding.



Fig. 5 (Below) Specially designed fixtures hold the two halves of a section firmly together while the flash along the edges is securely spotwelded.



exact shape and dimension in such a manner as to assist in dimensioning the engineering drawings. These models were also of help in constructing dies, tools, jigs, fixtures, and inspection equipment. Together with the designs for the dies, the models were turned over to the pattern department which constructed patterns for castings to be used in die construction, and to the jig and tool departments for the construction of assembly and inspection equipment.

While every section of the rings offered die problems due to lack of detailed drawings, construction of dies for drawing the center or #9 section in only two pieces was a distinct innovation (Fig. 1). The first and second draws had to be duplicates of each other. Top and bottom sections of the dies had to match exactly. Four tops and four bottoms had to be made perfectly interchangeable.

Each die was built sectionally, with each section mounted on a steel shoe so that it could be adjusted or replaced without retiring any part of the die from

service. Wooden die models were used to determine the shapes and sizes of various component parts of each die section. To get dimensions for castings for the dies, it was necessary to make a second set of wood patterns to shrink rule dimensions to allow for $\frac{1}{8}$ in. contraction. Drawing beads were located by trial and error, and each final die was built of an alloy cast die metal known as Strenis C. Wrinkles were eliminated within a short time by production experiment. The original dies are still producing and have more than justified their initial investments.

Although the Engineering Department followed tooling methods common to the automobile industry in setting up the dies for this new job, the Chief Engineer takes pride in the fact that less than 5 per cent deviation from the original production equipment plans has been necessary. The Production Department had its own struggles with the perplexing qualities of stainless steel, which drew perfectly at .050 in., but developed strange antics in other thicknesses. For die work, the Production Department finally settled on a metal with a satin finish rather than the smooth finish, which the dies could not grip so readily. Localizing of titanium in streaks gave additional trouble as steel specifications were altered to accommodate the necessities of the war effort. These streaks caused the metal to break during the draw process, and were a real problem. Production also brags about the work of its Experimental Engineer in devising and constructing pneumatic expanders and swagers, inspecting and straightening fixtures, pneumatic port flatteners, and a host of other devices custom-built for the job.

After welding, the ends of the sections were seldom exactly round or of the exact dimension required. Pre-war production had indicated that these apertures could be brought into round by the expansion of an opening originally made slightly smaller than necessary. Accordingly, American Central devised a line of specially-built expanders operated by compressed air (Fig. 2) which dilate the openings to correct size. However, quantity production quickly developed the fact that swaging down to proper dimension was a better procedure, the reason being that the critical

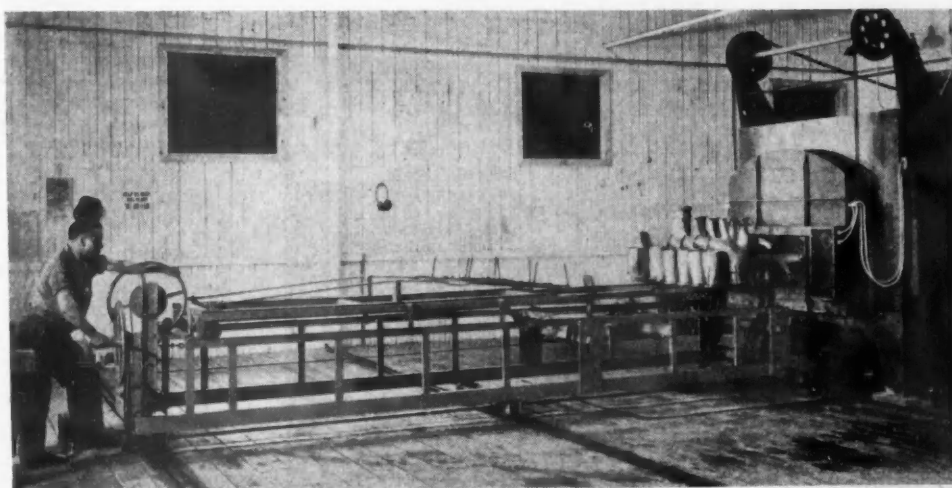


Fig. 7 (Left) Heat-treat furnace is equipped with automatic loader to facilitate handling of collector ring sections.

Fig. 8 (Below) All plug and ring gages required for final inspection of collector ring sections are mounted on a single panel alongside the final inspection plate, which duplicates connection details of the engine itself.

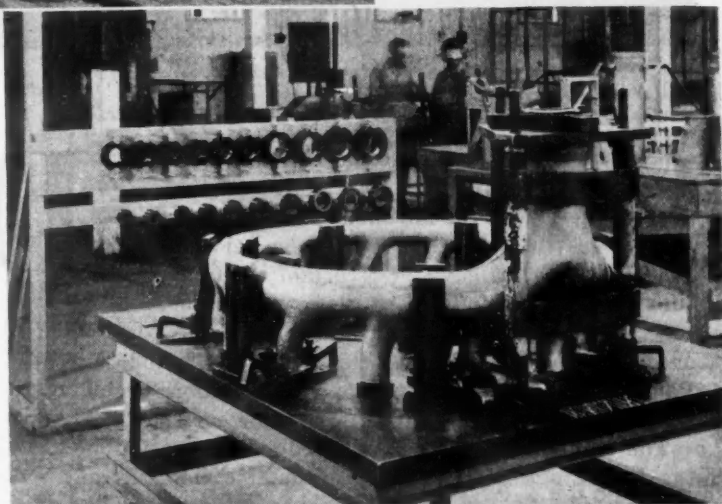
part of a draw might already be slightly too thin, in which case expanding merely exaggerated the condition. Swaging, on the other hand, tended to thicken the thinnest areas by compression of metal, and thus produced a more uniform wall structure. To meet this situation, a line of swagers, also pneumatic, were built (Fig. 3). These machines have hydraulic stops.

Inspection and straightening are carried on by means of fixtures combining both operations, one machine size being furnished for each section. Previously, the entire ring assembly was tested on a single fixture, which had no self-contained means of correcting any errors found, and which did not permit enough sections to be tested at one time. By means of hand screws on the new machines, any part of a given section may be brought into alignment from any direction, quickly and accurately.

Earlier practice—in the “hammered out” days—required a workman with a strong back, a wooden lever about the size of a ball bat in thickness, but much longer, and a great deal of hit-and-miss straining and prying. This method was slow, cumbersome and dangerous to the men, and is being supplanted by the mechanized procedure described above.

The pneumatic port flattener (Fig. 4) was designed to flatten the bolting flanges at a single squeeze, and was built in the company's own shops. Based on the alligator-type riveter, which it resembles, the machine exerts a pressure of 16,500 pounds between its two jaws when operating on 50 pounds of air. The jaw pressure can be stepped up to 30,000 pounds by raising the air pressure to 80 pounds. By use of these pressures, the face of the port flange is easily flattened into a smooth surface requiring a minimum of grinding.

To acquire a supply of welders for mass-production of collector rings, American Central decided to reserve its men welders as instructors and key personnel, while training new girls for the bulk work. It there-



fore instituted its own school for girls from 18 to 30, an age limit which has since been raised to 45 years. The company has found that its trainees should ideally weigh from 110 to 140 and be between 4 ft. 10 in. and 5 ft. 6 in. in height, but these standards are also subject to exception. Physical examinations are exacting. In the early stages of their training the girls learn how to light and adjust a torch, regulate gas mixtures and pressures, and attain continuous seam welding with good penetration, porosity and appearance. Practice is instituted on mild steel, with trainees advancing to actual shop production in the latter part of the training period, to minimize change-over to plant conditions. All students take a rigid examination to become certified Army and Navy welders; are rated as alert, intelligent workers; and have taken over more than half the welding jobs in the plant.

Specially designed fixtures (Fig. 5) hold two halves of a section firmly in place while the flash along the edges is securely spotwelded. The angles at the bends of the flash are sharp enough so that penetration from the spotwelds holds the halves together after the flash has been sawed away to within $\frac{1}{8}$ in. of the tube. The length of the seam is then gas welded and inspected by girls who have become expert at continuous

(Turn to page 56, please)



Perspective view of part of Continental's molding department. Here a wide variety of sizes and shapes are molded in hydraulic presses of standard and special design.

CONSIDERING the life span of the automotive industry, it is a noteworthy achievement for anyone associated with it to mark 40 years of continuous service. That indeed is the enviable record of the Continental Rubber Works, Erie, Pa., whose history harks back to 1903 when its founder—and still president and active head—Theron R. Palmer, envisioned the vital position rubber would occupy in the development of the motor car industry.

The trade-mark "Vitalic" earned its reputation in the beginnings of the enterprise on bicycle tires at the turn of the century. First products of the plant included bicycle tires, carriage tires, bumpers, and accessories. From the very start of automobile manufacturing, Continental contributed the rubber windshield weatherstrip for two-piece windshields. At that time, weatherstrips accounted for more rubber than any single item save tires. During the past 20 years Continental has produced a large part of motor car weatherstripping used by the industry. Another of the pioneering developments stemming from the research work in this plant was the invention of the one-piece hard rubber battery box for motor vehicles, produced in a specially designed hydraulic press.

By dint of diversification, Continental developed many items of rubber mechanical products for the automotive industry, including:

Rubber hose—comprising a line of some 125 types for all manner of industrial applications.

V-type fan belts.

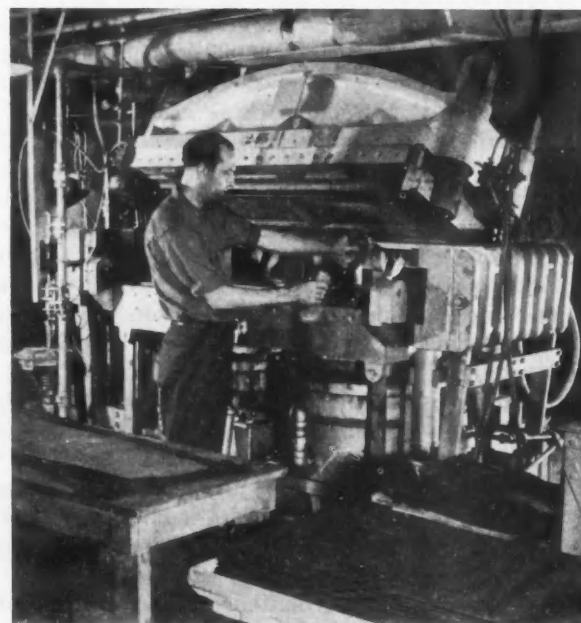
Large variety of extruded forms for bumpers, weatherstrips, channel, T-head, etc.

Molded rubber parts—grommets, bumpers, bushings, boots, rings, radiator hose elbows, etc.

Various die-cut and lathe-cut goods of precision character for all manner of gaskets and seals.

In all, Continental produced an amazing variety of mechanical rubber products for the industry—some standard, mostly tailor-fitted to individual requirements. With the inception of the war program, the experience thus gained was adapted without loss of pace to the manufacture of rubber goods for the vastly expanding military aircraft industry. Here we find

Diversity



Here is a close-up of one of the special hydraulic presses in the molding department. Note the tilting head construction which permits ready access and simplifies the problem of mold removal and installation. In the closed position, the head is clamped securely in place by the rails at the side.

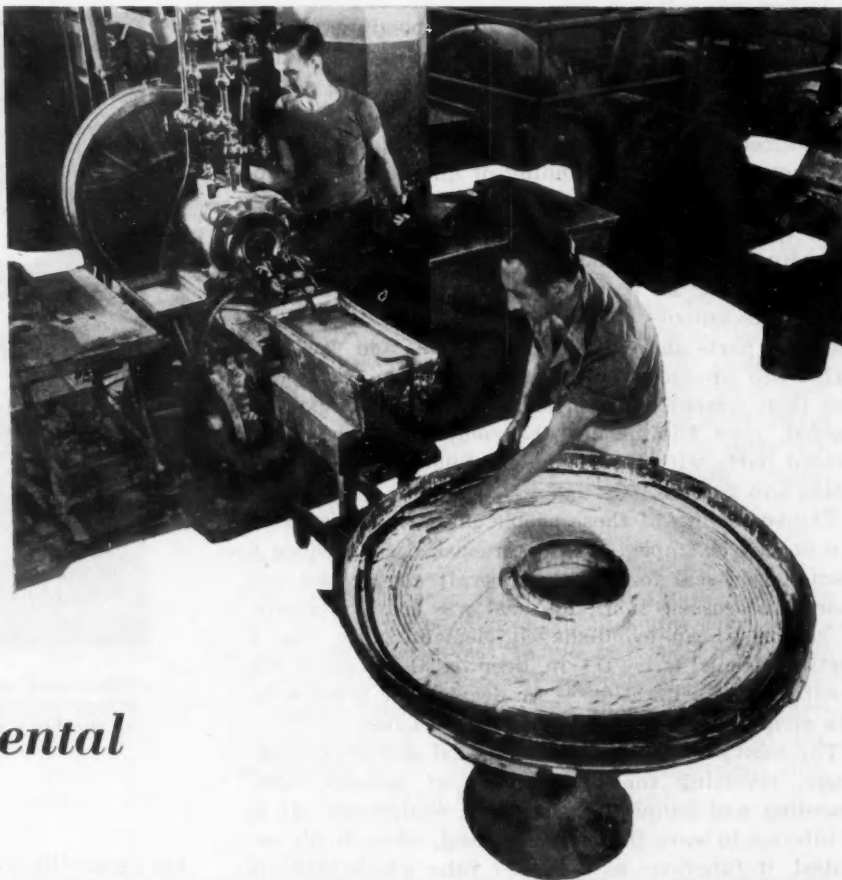
a wide variety of molded, extruded, and die-cut products covering many new applications among which are the following:

Grommets.
Chafing strips.
Oil hose.

Cup packings.
Oil seal rings.
Fume sleeves.

Extruding—the equipment shown here is typical of Continental's facilities for producing extrusions of great variety—tubing, weatherstrip sections, etc. This operation is producing tubing which is coiled by the operator in the foreground, preparatory to the curing stage.

By
Joseph
Geschelin



Marks the Continental Line of

Mechanical Rubber Products



Fuel check valve gaskets.
Sealing strips.
Hydraulic packings.
Bomb bay door seals.

Windshield weatherstrips.
Armor plate cushions.
Vibration dampener buttons.
Aileron boot bellows.

However, the aircraft era as well as the incidence of the pinch of the war on basic raw materials brought with them some new and difficult problems. Not the least of these were the specialized compounds required to meet the unique needs of special aircraft applications, the shift to synthetic rubber-like compounds, and the constant shifts from one type of synthetic to another depending upon the availability of such materials from time to time.

Here was a situation calculated to test the technical skill and talents of the research organization. Their long background of experience stood in good stead. Although the constantly changing picture of available raw materials produced many headaches and tried the patience of the organization, and although

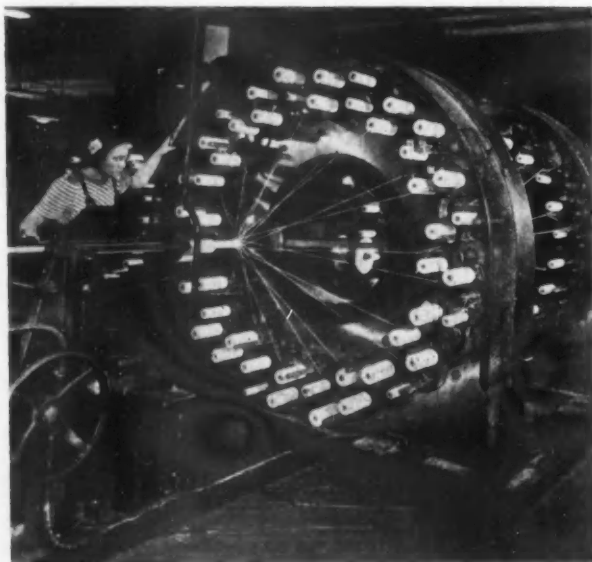
Close-up of one of testing stations in the Continental main laboratory. At the left is a Stickney test machine; at the right, Scott tensile testing. These are a part of the program of fundamental research and production checking which are constantly in progress.

such sudden shifts required a corresponding change of pace in development and plant management, the lessons learned in this brief period should have a profound influence upon postwar activity. Continental has gained a wealth of knowledge and practical experience with the compounding of all manner of rubber and synthetic rubber-replacing materials. Moreover, it has achieved a facility in the molding and extruding of forms and sizes heretofore considered impractical on an economical basis. They have developed techniques for producing intricate molded manifold parts and elbows. Large seals and weatherstrips are produced by extrusions which are cut to size then cemented to corner sections which may be molded, thus eliminating the complication of large molded parts with their incident huge and expensive molds and presses.

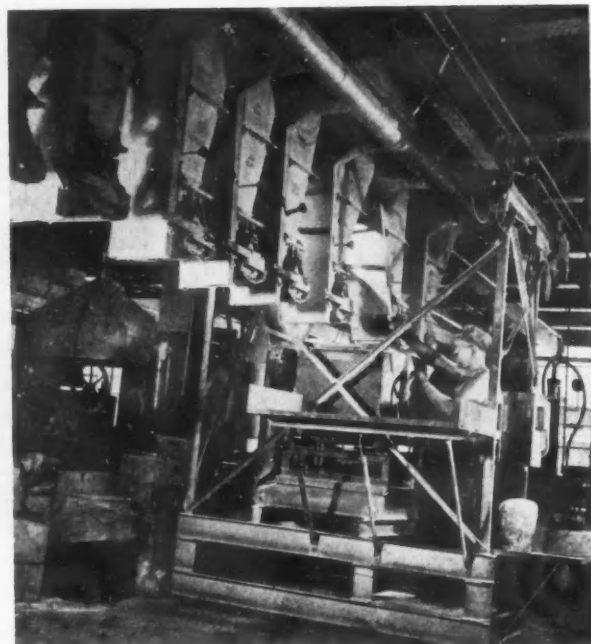
The versatility of these people can be illustrated by one notable example. They were asked to produce a special door seal for a huge aircraft engine test cell door. In cross-section, this seal was most intricate. It comprised an ovoid-shaped element quite like a partly flattened tire— $1\frac{3}{4}$ in. deep by $3\frac{1}{4}$ in. in width—with a channel section $\frac{3}{4}$ in. deep at the lower side. The strip had a developed length of 140 feet.

The solution was found in a special extruding technique, involving the development of suitable compounding and unique extrusion die equipment. It is of interest to learn that this door seal, when finally installed, it functions as an inner tube which make it possible to inflate the seal to any desired pressure or deflate it to the smallest compass by the application of vacuum.

From the standpoint of our readers the foregoing comment is perhaps of greater importance than the details of the actual techniques of doing the job. It is of further interest to look into the mechanism of how the company serves its customers. In the first place,



Braiding hose—aircraft oil lines and similar applications which require braided hose are produced on automatic equipment such as is shown here.



Compounding—exact proportion of material and proper mixing are assured by the use of the latest type of Banbury equipment as well as the employment of precision methods.

the proper liaison between the factory and the user is achieved through personal contacts by the establishment of factory branches and sales offices throughout the country. There are 20 such offices, 17 of which carry a complete warehouse stock for the jobbing and retail trade.

The sales offices constitute the immediate contact with the industry. They study the individual problems of automotive plants, discuss the applications with engineering departments, and pass this information on to the factory for final action. Wherever special problems are involved, perhaps beyond the scope of the field representative, Continental assigns a factory technician to the project for consultation and ultimate development in the laboratory.

The laboratory and its technicians trained in rubber constitute the background of the manufacturing establishment. For in this technical field every step in the process—the selection of compounds, compounding, molding, or extruding, etc.—all are subject to controls established and supervised by the laboratory. All raw materials as well as compounds to be used in production are tested in the laboratory. This control extends to the manufacturing departments as well. For example, as batches—large or small—are prepared for production, samples of each batch are taken by the control staff, rapidly processed and tested. Meanwhile, the batches thus sampled are held until laboratory approval is received.

This close control has two objectives. In the first place, it assures specification materials and acceptable quality of product so far as the user is concerned; and, in addition, it eliminates spoilage and rejections and wastage of materials, thus contributing to sound

(Turn to page 74, please)

Magnesium in Aircraft

By J. C. Mathes

Development Engineer,
Dow Chemical Co.

THE accompanying table contains notes on the relative properties and the uses of the various magnesium alloys, in the form of castings, extrusions, forgings and sheet. In regard to C and H alloy castings, the as-cast condition, being cheaper, should be specified for miscellaneous non-stressed parts, the heat treated condition for maximum elongation and resistance to impact, and the heat treated and aged condition for maximum yield strength. In some cases the HTA condition is specified for high-temperature applications, such as some engine parts, where the temperature would cause the HT condition to age in service. A new condition, designated as "stabilized," and which can be imposed on either as-cast or HT castings, is even more effective than aging as regards dimensional stability and provides greater ductility than the HTA state.

Stress Corrosion

Work on stress corrosion is now in progress, both in the industry's laboratories and as a part of the National Defense Research Committee program, so that present data are therefore tentative. It has been observed that in service cracking due to stress corrosion only results from "built-in" stresses, the most serious offender being the high residual stresses resulting from arc-welding. It is believed that stress-relieving for one hour at 400 F will prevent this. Complete welded assemblies have been exposed at the Atlantic sea coast since November, 1942, and it was found that those assemblies, which were not stress-relieved, cracked at the weld area in about five weeks if bare and in about five months if painted.

This article is an abstract of the paper, "Experience with the Use of Magnesium in Aircraft," which was presented Oct. 2 in Los Angeles, Calif. by Mr. Mathes at the National Aircraft Engineering and Production Meeting of the Society of Automotive Engineers.

Those assemblies, which were stress-relieved, have shown no tendency toward stress corrosion even in areas that were purposely left unpainted. Cold-formed, unannealed panels have likewise shown no tendency toward stress corrosion even though unpainted. Riveted wings, constructed of J-lh sheet, have been flying for over 1½ years with no evidence of stress corrosion. It appears, therefore, that, properly appreciated and guarded against, stress corrosion should not be a serious factor.

Riveting Practice

For dimpled sheet 56SO anodized rivets should be used; for brazier head or machine countersunk rivets 56S1¼H anodized rivets should be used; 56S rivets have practically no electrical potential difference when in contact with magnesium and should be used wherever moisture is present. They can be driven dry. The use of A17ST rivets is not recommended, since

(Turn to page 67, please)

Properties and Uses of Magnesium Alloys

	Dow-Metal Alloy	Government Specifications	NOTES ON PROPERTIES AND USES
CASTINGS	H	AN-QQ-M-56, Alloy A	Most widely used, most easily obtained.
	C	AN-QQ-M-56, Alloy C	Used in place of H alloy: (1) For most permanent mold castings. (2) For some pressure-tight castings. (3) Where greater hardness and static yield strength are more important than toughness.
	M	AN-QQ-M-56, Alloy B	Cast fittings to be welded to M alloy sheet.
	R	AAF 11319, Alloy 1; Navy 46M11	Die castings.
EXTRUSIONS	M	AAF 11336, Alloy B; Bur. Aero. M-314C, Alloy 11	Non-stressed parts or parts to be welded to M alloy sheet. Cheapest.
	FS-1	AAF 11320, Alloy 1	Parts requiring higher strength than M at minimum cost.
	J-1	AAF 11335, Alloy 1; Bur. Aero. M-314C, Alloy 8	Slightly stronger than FS-1. Parts to be welded to J-1 sheet.
	O-1	Strongest. When aged gives highest yield strength, particularly in compression.
FORGINGS	J-1	AAF 11345; Navy 46M13, Alloy 8	Moderately stressed parts, non-porous—valve and pump bodies.
	O-1	AAF 11321-A; Navy 46M13, Alloy 9	Parts requiring maximum strength.
	M	Navy 46M13, Alloy 11	Can be hammer forged. Least expensive. Use where strength requirements not rigid; and soundness is major consideration.
SHEET	M	AAF 11339, Alloy 1; Navy 46M2, Alloy 11	Use annealed, for structural parts requiring maximum combination of formability and weldability.
	FS-1	AAF 11340; Navy 46M2, Alloy 18	Stronger than M. When annealed (FS-1a) has formability equal to or better than M, particularly for cold forming. Not as weldable as M or J-1h. When hard-rolled (FS-1h) is one of strongest Mg sheet alloys, but loses strength rapidly at temperatures over 275 F.
	J-1	AAF 11338, Alloy 2; Navy 47M2, Alloy 8	Strongest Mg sheet when hard-rolled. Primary structures. Arc-weldable. Applications requiring maximum strength and involving forming that cannot be done at room temperature.

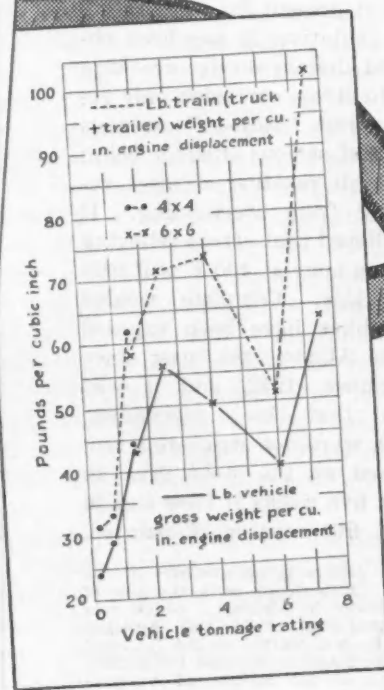
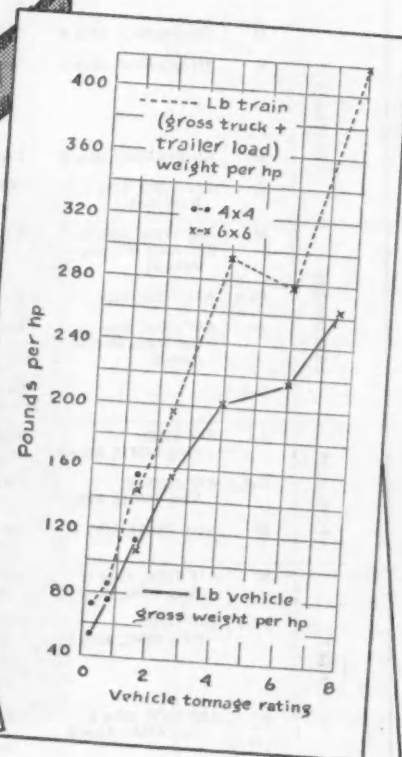
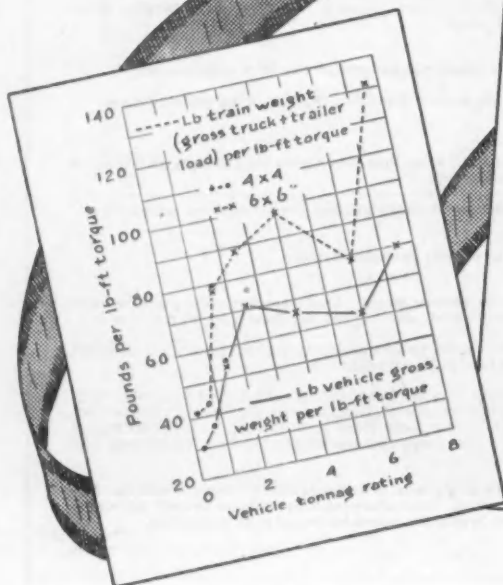
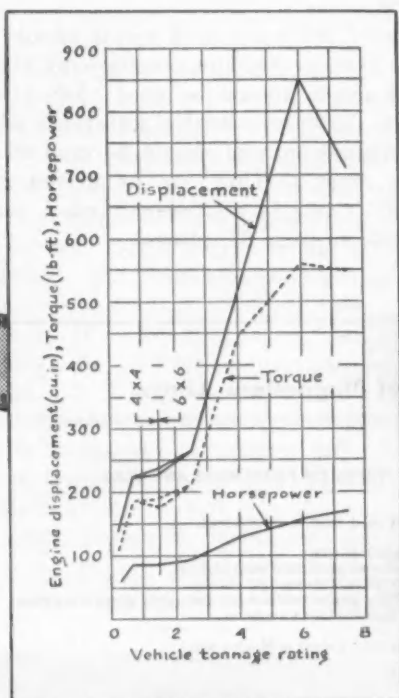
UNITED STATES ARMY trucks are classified under three types—administrative, tactical, and strategical. The classification under which a vehicle is placed is dependent upon the kind of terrain where it is designed to operate.

Administrative trucks are the housekeeping vehicles of the Army. They are used at posts, camps, and stations for movement of supplies, furniture, etc. These trucks operate most of the time on improved roads and a small percentage of time on secondary roads. Since this is the same type of operation which is encountered by commercial vehicles, it is only logical that commercial vehicles with a minimum number of changes are used. These modifications are of minor

Desert terrain encountered by Army trucks in convoy.

By Major Edward H. Holtzkemper

Military



nature such as being painted lustreless olive drab and incorporating the standard blackout lighting system.

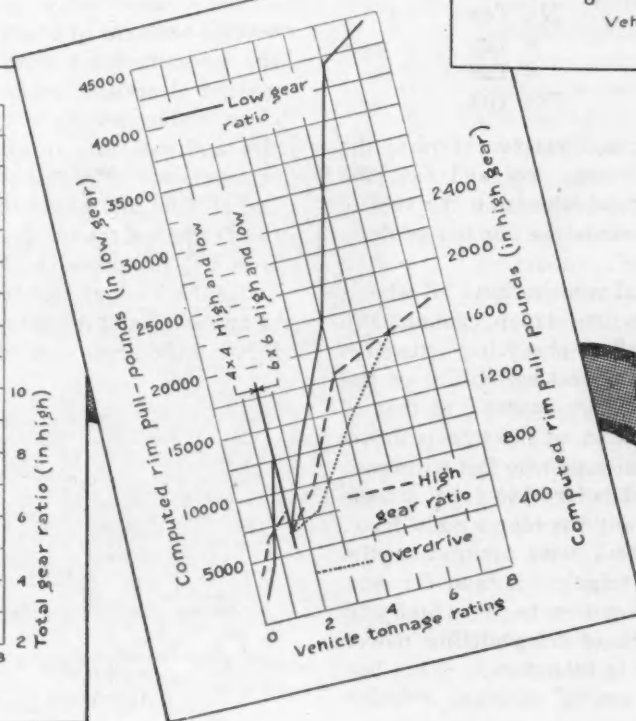
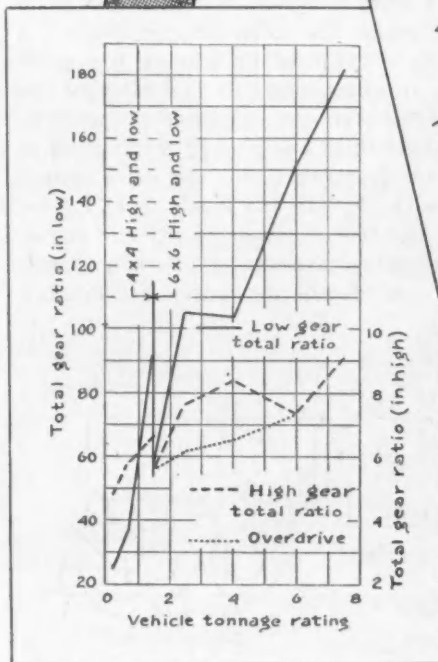
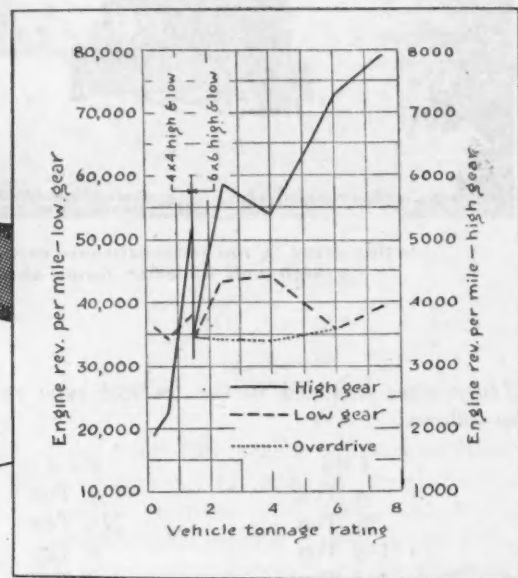
Tactical trucks are the vehicles which are assigned to service and combat organizations. They are required to transport troops and their supplies and to tow trailers loaded with additional supplies or wheeled guns to any position the unit commander designates. This may mean movement over a paved level road, across a hard-packed meadow, through a bottomless swamp, over a snow-covered mountain at sub-zero temperatures, or across a hot wind-swept sand dune area. This requirement for operation over all types of terrain under all temperature conditions necessitates the tactical vehicle to have more torque available



Truck Performance

at the wheels, improved flotation, and increased durability of all components over those in comparative size administrative vehicles.

Strategical trucks are a new type that have been added to meet the requirements of the Transportation Corps, which is charged with the movement of supplies and equipment to divisional distribution points. Under the old type of warfare where the movement of the battle lines was slow, usually only a few miles a day, it was possible to bring supplies and equipment by rail to a railhead which usually was also the division distribution point. Movement was then handled from there by Divisional vehicles. However, under the rapid-moving type of warfare encountered during certain phases of this war, rail systems are seldom available, such railheads as are available are quickly sepa-



rated by miles from the combat units, and bombing frequently makes the rail system unusable for periods of time. Hence, the Transportation Corps has a requirement for vehicles which operate a large portion of the time over secondary roads, but with limited ability for cross-country travel necessary to move around bombed sections of road. Thus it can be seen that the performance requirements of the strategical truck lie between those of the administrative and the tactical trucks.

Since the tactical truck is the most widely used in the Army and varies the most from commercial trucks, this article will be limited to a discussion of this type.



As this Army 3/4 ton reconnaissance car moves upstream, a high wall of water forms ahead of it.

Truck sizes included in the tactical type vehicle are as follows:

4 x 4	6 x 6
1/4 Ton	1 1/2 Ton
3/4 Ton	2 1/2 Ton
1 1/2 Ton	4 Ton
4/5 Ton	6 Ton
5/6 Ton	7 1/2 Ton

In the above sizes, the tonnage rating refers to the maximum payload. In the terms, 4x4 and 6x6, the first number represents the total wheels on the vehicle and the second number represents the number of driving wheels.

It will be noted that tactical vehicles have all wheels driving. Military engineers and troop commanders are thoroughly convinced, after observing extensive tests, that the cross-country operating ability of the all-wheel drive vehicle is markedly superior to that of a vehicle in which only a portion of the wheels drive. This is easily understood by anyone who has witnessed the piling up of mud or sand before the front wheels of a passenger car on which only the rear wheels drive.

The requirement for all-wheel drive complicates the mechanical structure of the vehicle. A transfer case is required to distribute the power to the front and rear axles. Also the problem of transmitting power to the steering front wheels is introduced. This has been accomplished by the use of constant velocity

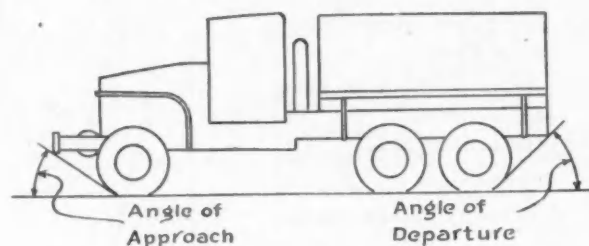
joints in the steering drive ends of this type of vehicle.

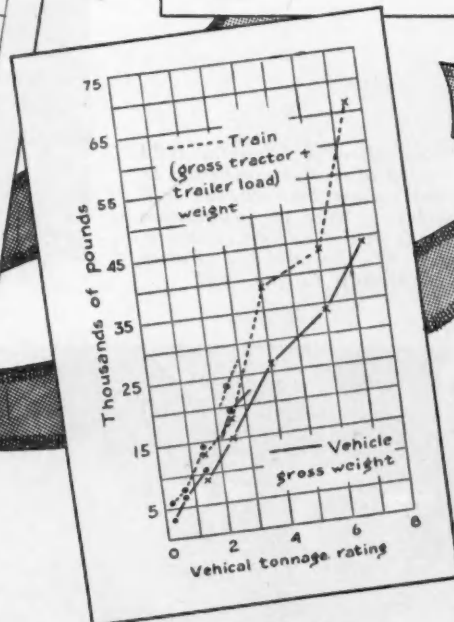
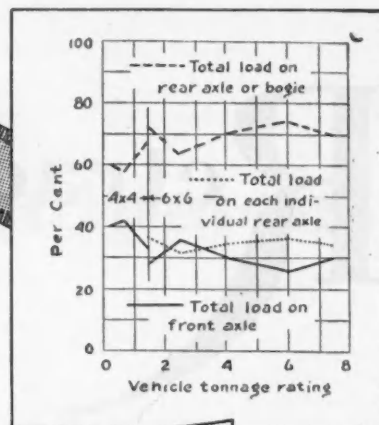
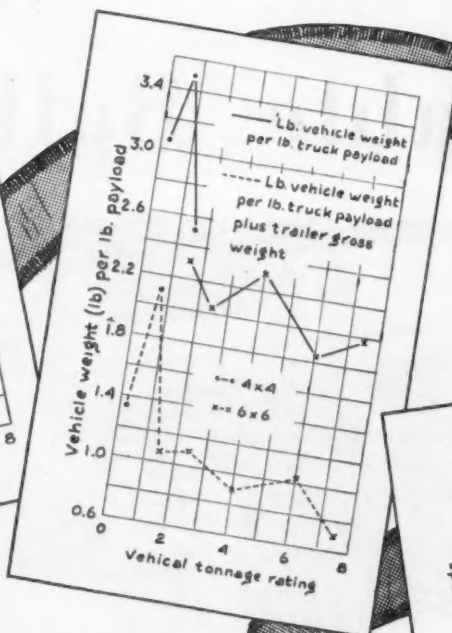
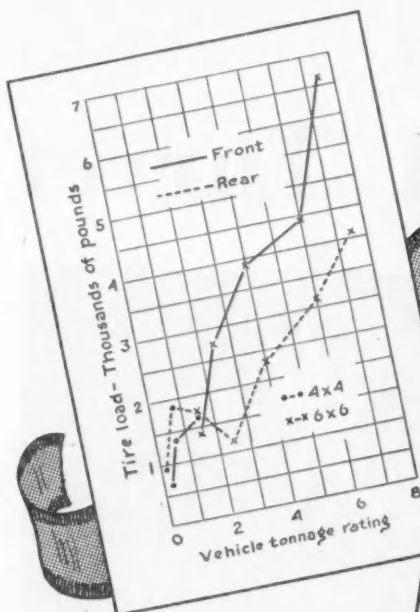
However, having all wheels power driven is not sufficient to insure off road operation. The wheels must not only revolve but must be able to grip the terrain being traversed. This grip is facilitated by the use of the military standard non-directional mud and snow tread tire, which is a compromise design utilizing lugs to firmly grip soft terrain and a continuous center strip to provide smooth and long mileage operation on hard surfaced roads.

To still further improve the tractive effort of the vehicle, each truck is equipped with tire chains for all wheels. In extremely tough mud operation the front wheels may be dualled to provide improved flotation. In addition, trucks assigned to the Field Artillery and utilized for towing guns are equipped with traction devices. These devices, in reality, equip the wheels with a wide track, and although somewhat strenuous on the vehicle, provide mobility approaching that of a track laying tractor.

Despite all these aids to traction, however, vehicles will sometimes become so badly mired they cannot move. To assist truck movement under these conditions, a percentage of vehicles are equipped with power-operated winches. These winches are mounted at the front on most vehicles. However, some are mounted in the center of the truck and others at the rear. Front-mounted winches are driven from a power take-off on the transmission. The rated line pull of the winches is roughly half the gross weight of the vehicle. The line pull rating is considerably below the tensile strength of the cable and all winches are equipped with shear pins which act as safety valves.

The cross-country operation requirement dictates several features of truck construction. One feature is the necessity for a clean under-chassis with maximum ground clearances under the axles and amidship. A clean under-chassis is obtained by placing the spare tire and gas tank in other locations and keeping the transmission and transfer case as high as possible, and all fuel and brake lines and electric wiring inside the frame. Ground clearance under the axles ranges from 8 3/4 in. under the 1/4-ton, 4x4 truck, to 13 1/3 in. under the 7 1/2-ton, 6x6 truck. Grade ability and angles of approach and departure are important when operating in hilly areas. Most military trucks will climb a





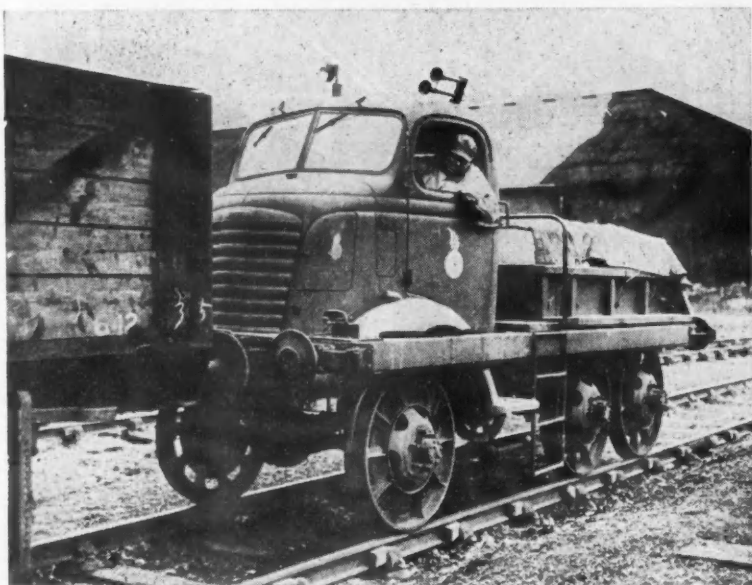
three per cent grade in high gear with rated payload and with towed load, and a 65 per cent grade in low gear with rated payload, but without towed load, providing traction can be obtained. Angles of approach vary from 35 deg on trucks with front-mounted winches up to 55 deg on trucks without front-mounted winches. Angles of departure range from 28 deg up to 60 deg. All trucks are constructed so they will operate through a maximum depth of water without the engine stalling. The $\frac{1}{4}$ -ton, 4x4 truck has the least water-fording depth—21 in. of still water—without vehicle modification. The vehicle turning radius is held to the minimum possible to facilitate maneuvering around trees, hills, and rocks. The turning radius varies from 17 ft. on the $\frac{1}{4}$ -ton, 4x4 truck to 48 ft.

on one model of the 6-ton, 6x6 truck in military service.

Cross-country operation of military trucks frequently requires low gear and high torque operation for extended periods of time which necessitates an efficient cooling system. This is accomplished by the use of large tube and fin-type radiators, and scientifically designed fans and shrouding. Examples of the still air temperature at which the cooling water in the trucks will commence to boil at maximum torque are 100 F for the $\frac{1}{4}$ -ton, 4x4 truck, and 120 F for the 4-ton, 6x6 truck.

The maximum speed of military trucks varies from 65 mph for the $\frac{1}{4}$ -ton, 4x4 truck to 30 mph for the $7\frac{1}{2}$ -ton, 6x6 truck. These vehicles seldom operate at their top speed. The usual average convoy speed over hard surface roads is about 25 mph. However, some vehicles are always falling behind the preceding vehicles and then operating at speeds greater than the average in an attempt to get their vehicle back to normal convoy spacing. This practice is known as

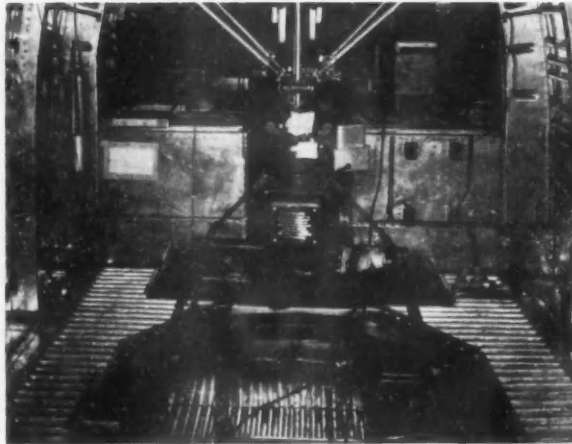
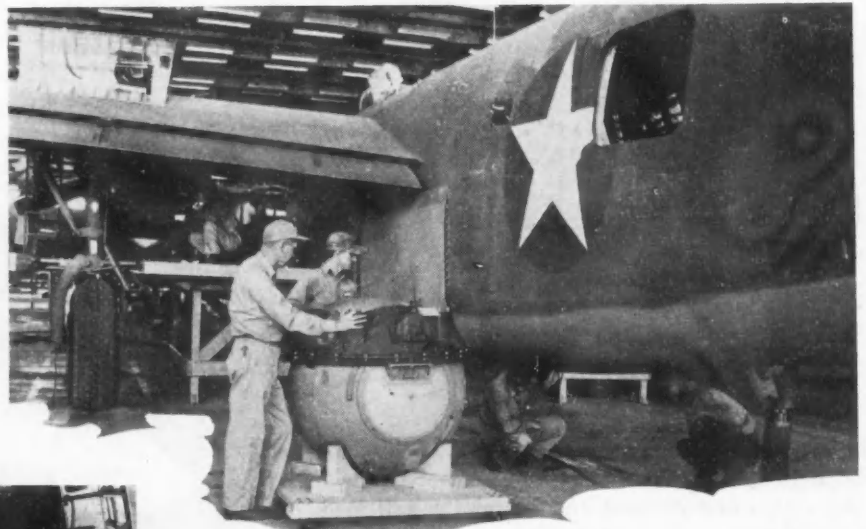
(Turn to page 60, please)



A U. S. Army $2\frac{1}{2}$ -ton truck converted for shifting cars on a railroad operated by U. S. Army Ordnance Dept. in England (British Combine photo).

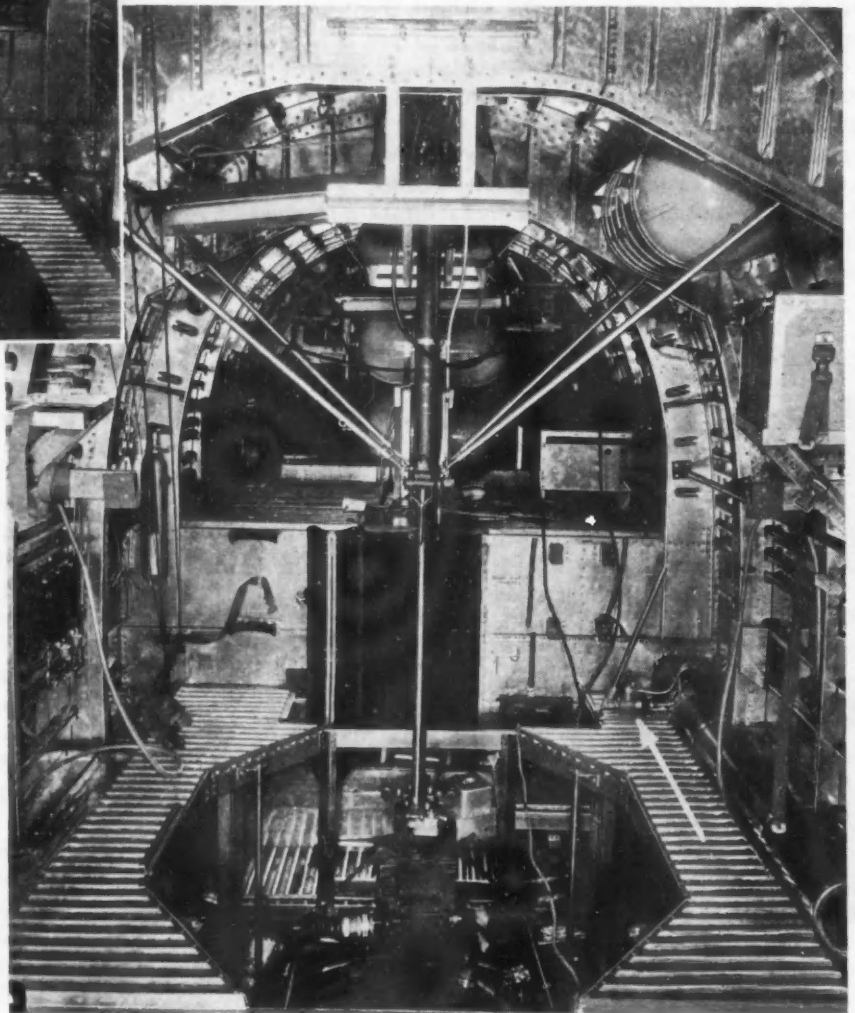
Retractable Ball Turret

(Right) The tail of a Liberator B-24 must be raised to enable mechanics to roll the ball turret beneath the well cut in its belly. Here an installation is being made at the Tucson modification center of Consolidated Vultee Aircraft Corp.



(Above) The Vickers hydraulic power unit for retracting the ball turret.

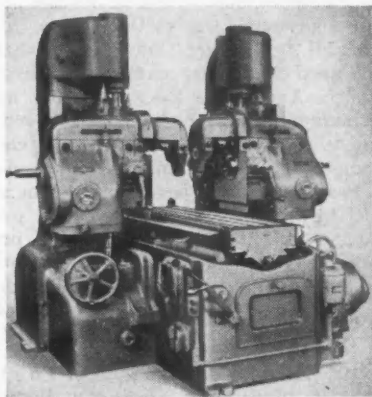
(Right) When the Sperry ball turret with its two .50 cal machine guns was added to the Liberator bomber, a retractable mechanism was necessary so it could be raised for landings and take-offs and when not needed in flight. The mechanism can be seen here in its lowered position. Note the auxiliary pump unit on the waist deck to the right and aft of the wall by which the turret can be raised or lowered manually if necessary.



New Production Equipment

THE tracer controlled Hydromatic milling machines manufactured by The Cincinnati Milling Machine Co., Cincinnati, Ohio, provide a sensitive tracer controlled vertical movement of the spindle carrier. Accurate duplication of master profile templates is obtained automatically, without attention or effort on the part of the operator, and automatic table cycles, synchronized with spindle carrier vertical movements, reduce the effort of operation to that required to load and unload the work holding fixtures.

The automatic hydraulic tracer mechanism, mounted on the spindle carrier,



Cincinnati tracer controlled Hydromatic milling machine

controls the vertical position of the spindle carrier during the cutting stroke of the table. A roller on the end of the tracer valve mechanism engages the master profile template attached to the work holding fixture. As the table moves, the roller moves along the top of the template and any vertical movements of the tracer valve, imparted by the roller, are automatically duplicated in magnitude by the spindle carrier.

Table and spindle carrier movements are automatically synchronized in such a way that the spindle carrier will always be in its uppermost, or retracted, position before the table can move at the rapid traverse rate, and conversely, in the lowered, or cutting, position, with the tracer roller engaging the master profile template, before the table can move at the feed rate. This feature gives an automatic vertical advance and retraction of the cutter

which lends itself to the milling of "blind end" cuts, by lowering the cutter behind obstructions in the work or fixture.

An automatic variable feed attachment is available, at extra cost, which provides automatic, cam-controlled variations in feed rate to permit constant maximum metal removal regardless of variations in the width and depth of cut.

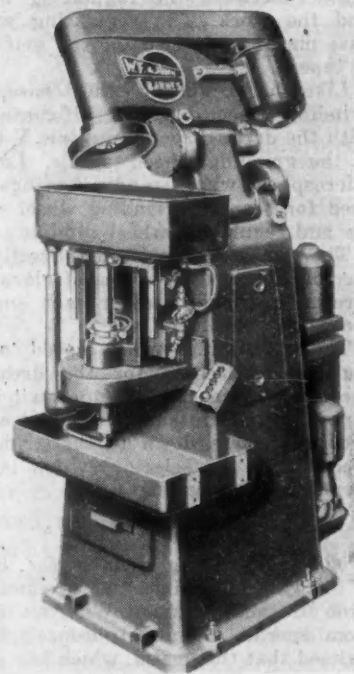
A selector valve provides for disengagement of the automatic tracer control and permits the use of the machine for heavy duty production type work. Automatic table working cycles, combining feed and rapid traverse of the table in both directions, are retained when tracer control is disengaged.

Table feeds are hydraulic and are infinitely variable under the control of a single throttle-type lever. Since two-way feed cycles are supplied as standard on these machines, cuts may be taken in either or both directions.

THE Barnes No. 4 optical curve generator, a recent development of W. F. and John Barnes Company, Rockford, Ill., is equipped with a special hydraulically actuated system for automatic cycle operation. One or several machine can be operated by a semi-skilled operator, who has only to insert the lens or block in the holder, press a button to start the cycle and then remove the work when the machine has automatically shut off after the work is completed. The proper curvature is obtained by two angular



Landis No. 12 centerless grinding machine



Barnes No. 4 optical curve generator

adjustments of the top spindle arm plus a differential screw micro-adjustment incorporated in the spindle.

This machine can be used either singly with one all-purpose grit diamond tool or a battery of two or more machines may be used wherein the first machine is equipped with a coarse grit (100) diamond tool that will quickly rough grind to approximate size and curve and the second machine equipped with a fine grit (400) diamond wheel for finish grinding of the lens.

For single lens operation the machine is equipped with a vacuum holding device where lenses having sufficient edge thickness can be chucked and held in the work spindle without the use of blocking pitch.

LANDIS TOOL COMPANY, Waynesboro, Pa., has added the No. 12 centerless grinding machine to their line of grinding equipment. This new machine is designed for thrufeed, infeed or end-feed operations.

The regulating wheel base is completely self-contained. Drive to the

spindle is from an adjustable speed motor through multiple V-belts. An infinite number of regulating wheel speeds may be secured by turning a control knob at the front of the bed and with no interruption of the grinding cycle.

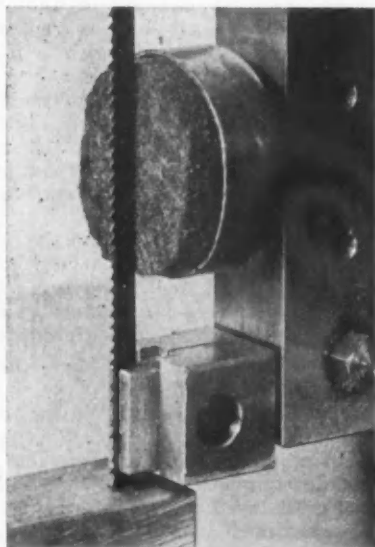
One of the features is the hydraulically operated regulating wheel base cross slide. This facilitates the dressing of the regulating wheel by virtue of the fact that the wheel face is traversed across the point of a positively held diamond. The wheel dresser is so mounted that the path of contact between the regulating wheel and the diamond is the same as the path of contact between the regulating wheel and the work. The regulating wheel base may be swiveled for the grinding of tapers.

Like the regulating wheel base, the grinding wheel base is self-contained with the drive through multiple V belts to the grinding wheel spindle. Landis Microsphere wheel spindle bearings are used for both the grinding wheel spindle and regulating wheel spindle.

The work rest is mounted directly on the machine bed. A series of elevating screws is provided under each end of the work rest blade.

The regulating wheel speed automatically increases for the dressing operation when the selector switch is turned to the dressing stage and automatically slows down to the grinding speed when the selector switch is returned to the grinding stage.

GROB self-seating guides for band sawing machines, a product of Grob Brothers, Grafton, Wis., are made from special aluminum bronze. It is claimed that this metal, which has good wearing qualities, allows the saw band to seat itself and will not damage or score the blade. These guides can be adjusted to support the saw band immediately above and below the work, which is especially important when



Grob self-seating band saw guide

using narrow blades. Long life of the guides is assured by a felt oiler mounted directly above the upper guide.

THE Denison Engineering Co., Columbus, Ohio, is announcing a recently developed hydrostatic test press. This particular press is said to lend itself to many specialized jobs such as determining the strength of materials and designs. It simplifies testing of drawing qualities of metals, fatigue in



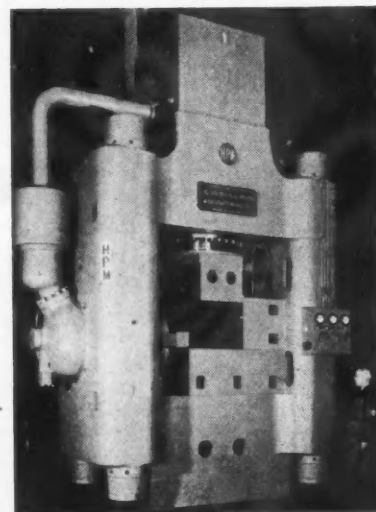
Denison hydrostatic test press

metals and alloys, and the influence of heat treatment. It also facilitates comparison of welding methods.

Coatings for metals such as paints, enamels, and plastics can be tested by alternate applications of pressure, simulating expansion and contraction. External pressure may be employed to determine the strength of all types of containers. The press features simplicity and convenience of operation. The clamping portion makes it possible to test articles of various heights without the inconvenience of retooling.

THE Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, has completed one of the largest hydraulic presses ever built for powder metallurgy. The press was designed for briquetting powdered carbides of tungsten, titanium or tantalum for carbide cutting tools, dies and inspection gages. It is also suited to other powdered metal forming which requires the application of high pressure from two different points.

H-P-M hydraulic presses for powder metallurgy may be designed to meet the customer's particular production requirements. The press illustrated will exert a 1500 ton downward acting force, and a 1000 ton horizontal acting force.



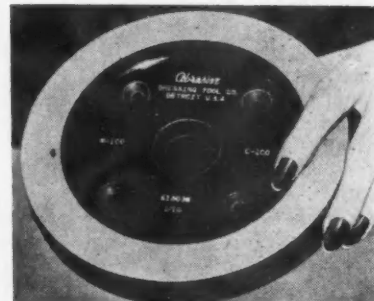
H-P-M hydraulic press

The press is completely self-contained, being equipped with two H-P-M Hydro-Power radial hydraulic pumps which generate the operating pressure. These are directly connected through flexible couplings to a 30-hp double-end-shaft electric motor. H-P-M Fastraverse pre-fill valves provide direct communication between the overhead oil tank and the two pressure cylinders. As the press rams advance, the cylinders are filled with oil by gravity, thereby eliminating the need for large capacity hydraulic pumps. As soon as the press rams meet resistance, pump pressure quickly builds up on the work. A fast press cycle is assured. The press embodies a standard H-P-M hydraulic operating system permitting absolute control over all press movements, both as to speed and pressure. Press operation is automatic, with electric pushbutton starting and automatic predetermined pressure reversal.

THE Abrasive Dressing Tool Co., Detroit, Mich., has opened a diamond wheel department, offering for immediate delivery a standard line of diamond wheels.

Abrasive resinoid-bonded diamond wheels are specially designed for the fast cutting of carbides, for providing uniform cutting edges on carbide-tipped tools of all kinds, for the removal of excess metal on carbide dies and for

(Turn to page 52, please)



Diamond wheel made by Abrasive Dressing Tool Co.

THE new Series 50 Diesels, recently introduced by Joshua Hendy Iron Works, incorporated into one model a wide range of modern design features for stationary and marine services. Hendy Diesels are 4-stroke cycle, with a bore of 12 in. and stroke of 15 in., and are normally rated at 83.3-hp per cylinder at 500 rpm. Incorporated in the cylinder-head assembly are unit-type fuel pumps and injectors combined with the overhead valve mechanism. Unit fuel injectors in each cylinder eliminate the need for long, high-pressure fuel lines between the injection pump and the nozzle. Heads are cast from Meehanite with large water passages for cooling of valve guides, injector, and valves, dead-water spaces being eliminated by jet action.

Smaller valve diameters and closer volumetric control are achieved with dual intake and exhaust valves, which operate in removable guides. Rocker arms bear on slotted cross heads or dividers so that pressure is

New Hendy Series 50 Diesel

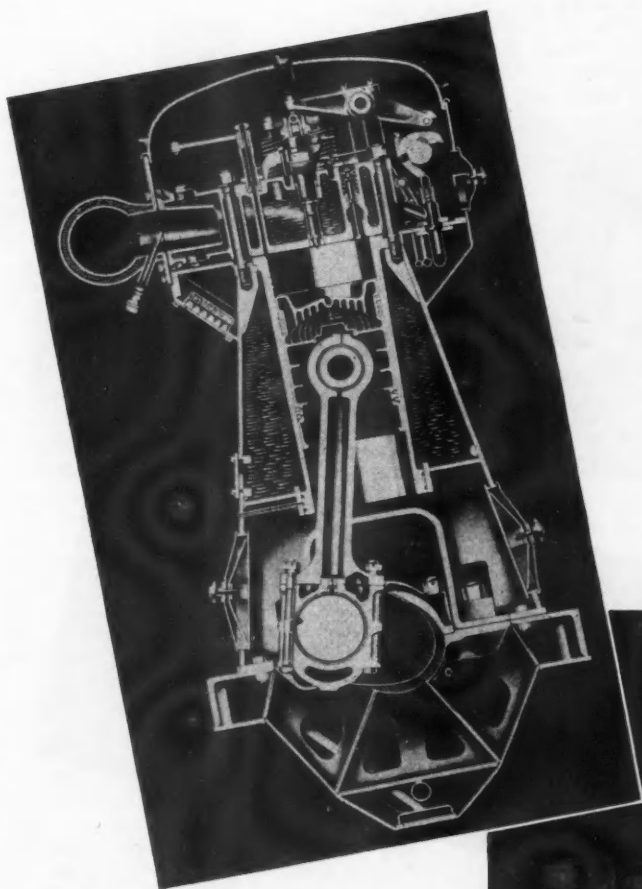
evenly distributed on the dual intake and exhaust valves and side thrust eliminated on their stems. Valve action is further controlled by hydraulic tappets that automatically take up clearance.

An integral feature of the head-assembly design is the overhead camshaft, 3 in.-diameter ground steel, which is fitted with forged and case-hardened steel cams, keyed to shaft. Camshaft bearings are force-feed lubricated through drilled holes. In reversing-type engines the camshaft is moved axially by a pneumatic cylinder.

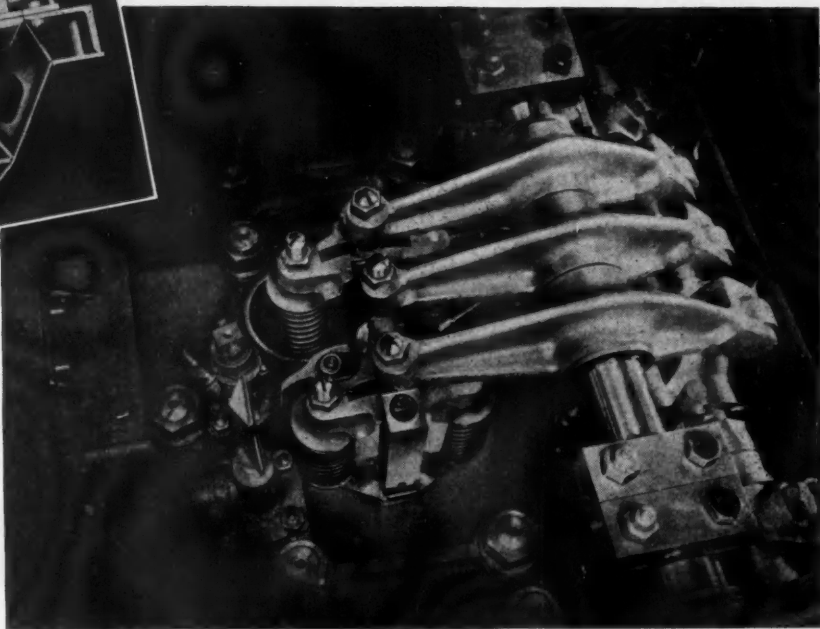
Both engine bed and cylinder block are of welded steel construction, with heavily ribbed, deep sections on the bed. In the cylinder block the circulating water is confined to the removable cylinder liner by use of jackets on each liner; thus none of the cooling water is in contact with the block.

On marine models, reversible-type centrifugal pumps circulate raw and fresh cooling waters. Tube-type cooling-water heat exchangers, with fresh and raw water pumps and complete piping, are integral parts of Hendy Diesels. In this way salt-water corrosion is eliminated and more-efficient operating temperatures are maintained. The water-cooled exhaust manifolds

(Turn to page 62, please)



(Above) Transverse sectional view of new Hendy Series 50 Diesel engine.



(Right) Dual intake and exhaust valve mechanism.

By C. A. Hedges

Production Design Engineer,
Lockheed Aircraft Corp.

Forming Properties

Of Vulcanized Fiber Sheet

VULCANIZED fiber is a material which has long been available in sheet, rod, and tube form, and has been widely used in certain industries. It also lends itself to forming in dies, but its forming or drawing properties were not well known, and Lockheed Aircraft Corp. therefore decided to run a series of tests to determine these properties. Three types of fiber were tested, all of the "National" brand and commercial grade, viz., red fiber in gages from 0.040 to 0.064 in., black fiber of 0.032 in. gage, and gray fiber of 0.040 in. gage. According to the manufacturer, the National Vulcanized Fibre Co., these fibers have tensile strengths of 5000 to 8000 psi, crushing strengths of 40,000 to 42,000 psi, a Brinell hardness of 10, a specific gravity of 1.15, and water absorption of 65 per cent by weight after one hour's immersion.

In carrying out the tests, several pieces of fiber were bent dry, while other pieces were soaked for different periods and then bent. Form blocks and hold-down blocks of Hydro-stone were made for various aircraft production parts. Blanks were trimmed, soaked, formed over the blocks by hand, held in place with cover blocks, and placed in an oven

at 350 F to dry. Two Kirksite dies for production parts were cast, and lead punches were formed and ground to provide clearance. The dies were heated to 350 F, and blanks previously soaked in water were placed in the hot dies, formed, and allowed to dry before removal.

Several parts were coated with clear Resistite furnished by the Tibbetts Corp. of Los Angeles, and other, identical parts were left uncoated. Parts so treated were allowed to stand in air for 24 hr, while others were soaked in water for various periods up to 24 hr.

A Kirksite draw die was made, rubber strips being used for pad pressure. The die was made for a box with corner radii of 5/32, 1/4, 3/8 and 1/2 in. Blanks were soaked and formed in the die on the arbor press.

A cup die of 5 in. diameter

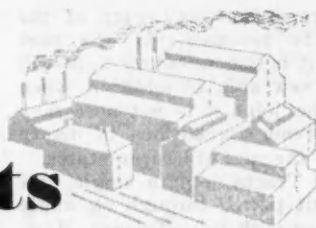
(Turn to page 64, please)



Tooling and formed parts of vulcanized fiber.



New Products



Heavy Duty Clutch Plate

A heavy-duty clutch plate which is said to permit two to three times more service mileage than conventional plates for trucks, busses and other heavy vehicles, has been developed by The Monmouth Products Company, Cleveland, Ohio.

Known as the Monmouth "Metallix" clutch plate, this flexible center-drive plate absorbs sudden torque and dampens vibration due to uneven power impulses. Patented construction prevents breakage of springs around drive hub



Monmouth Metallix clutch plate

and prevents them from becoming permanently set.

Each face plate has six spring steel segments to cushion the clutch action, assure smooth, positive operation and permit safe pick up of heavy loads.

Comparator to Measure Torsion of Small Springs

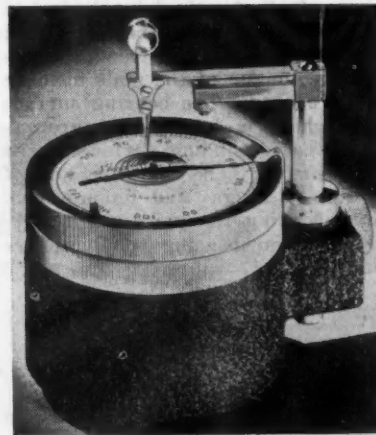
The torsionmeter now being produced by the Sheffield Corporation, Dayton, Ohio, is a comparator which provides a means of precision measuring the torsion of small spiral springs. A direct reading of the torsion measurement of the spring being checked can be made in millimeter grams on a graduated Manross scale. This permits the identifying and classifying of springs as to torsion before assembling in instruments.

The torsionmeter will accommodate springs up to 2 1/2 in. in diameter with a maximum torsion measurement of 49.5 millimeter grams. This is sufficient capacity to practically cover the complete range of springs used in most instruments.

The inner end of the spiral spring to

be checked is attached to the center post. The outer end is grasped by the suspended tweezers. The outer marker is set at 120 on the scale which represents the "zero" point. The dial is then turned one complete revolution. The point at which the indicator rests on the scale represents the torsion classification of the spring.

The indicator spindle rides on a jewel bearing and has a resistance of nearly zero. The pointer is made of non-magnetic material and the pointer assembly is statically balanced. The instrument is highly accurate as indicated by its consistent repeat readings.



Sheffield comparator

Constant Velocity Universal Joint

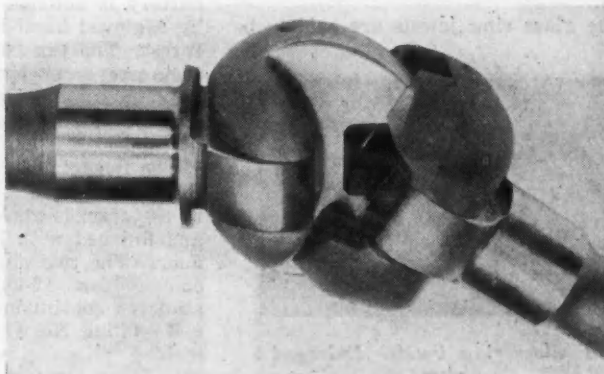
As manufactured by the New Process Gear Corp., owners of the patents, the Tracta constant velocity universal joint, used in the front wheel spindles of the American Jeep and other military vehicles both here and abroad, is characterized by large bearing areas for transmission of torque, low cost of manufacture and simplicity in servicing and installation.

The Tracta joint comprises a tongue and a groove member which engage each other and are in turn engaged by forked driven and driving shafts. Because the power transmitting surfaces within the joint are large, SAE 4027 steel can be used with consequent low material costs. The diameter of the joint can be kept small with the result

that any static or dynamic unbalance will be small. In addition, the possibility of Brinelling with increased friction developing within the joint is reduced to a minimum.

Lubrication of the joint is simplified because of the low unit loading. As manufactured by the New Process Gear Co., the parts of the joint are Luberized after heat treating and, in operation, conventional grease has been found to be satisfactory. There is no necessity for using extreme pressure lubricants. In a test the Tracta joint was driven without a lubricant and at the end of 4000 miles the various parts were said to be still in serviceable condition. From the maintenance viewpoint it should be pointed out that the unit

Tracta constant velocity universal joint manufactured by the New Process Gear Corp.



is so designed that any part of the joint can be replaced. If one part should fail it is not necessary to install a complete new unit. In addition, when servicing the joint it is not necessary to take extreme precautions to insure cleanliness, the manufacturer states.

With the Tracta joint a single unit will transmit power through an angle of 45 degrees with full efficiency. However, the joint illustrated, which was designed for the Jeep, is limited to a 38 degree angle.

The Tracta constant velocity joint, which was originally patented in France by Fenaille, can be used with torque tube drive and it is particularly applicable to front drive cars and to independently sprung driving wheels.

In manufacturing the joint the forked ends of the shafts are broached and shot blasted to increase strength. The slot in the tongue of the male member is also broached. The bearing surface for the shaft is turned and ground, as is the corresponding surface of the female member. The curved groove of the latter is rough- and finish-milled. After hardening the parts are Lubrized and then bearing surfaces are ground.

General Purpose Buna N Stock

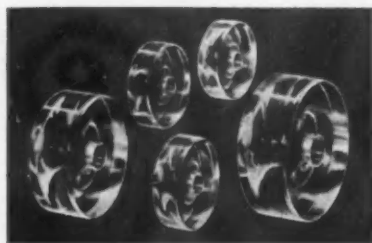
A general purpose stock for use in oil seals, gaskets, "O" rings, and other types of fuel seals and parts requiring resistance to heat and oil, is being introduced by Los Angeles Standard Rubber, Inc., Los Angeles, Cal.

The new Buna N stock (143-18), in addition to its high heat and oil resistant qualities, is flexible to -35 deg. F.

G.E. Announces Glass Ring Jewels

Glass ring jewels, made by the General Electric Company, Schenectady, N. Y., for certain of its aircraft instrument bearings, are now available for many other applications. The jewels are listed in five sizes for use in precision measuring equipment, and other shapes and sizes are possible for such applications as thread guides, weighing scales, automobile and truck speedometers, and similar instruments and devices.

The glass ring jewels are said to be



G-E glass ring jewels. Enlarged view

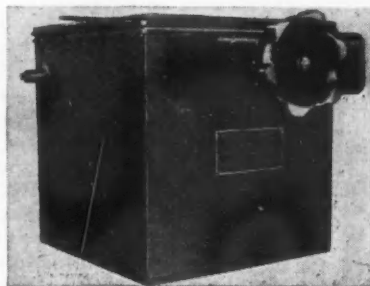
superior to sapphire in many respects and are available at approximately 1/3 the cost. They can be press-set or spun-set into bearing plates and other elements in the same manner as sapphire rings.

Surface of the hole in the glass ring is fire-polished in manufacture and is not touched subsequently. The flat surface opposite the "bell end" of the hole is highly polished by brushing with a suitable abrasive. This surface is also slightly chamfered at the edge of the hole and at the outside edge of the jewel. Outside diameter of the opposite flat surface of the jewel is also slightly chamfered to facilitate press setting and to avoid a fragile edge which might easily chip in transportation.

Dimensions are held to extremely fine tolerances; concentricity of the inside and outside diameters of the bearings is unusually accurate. The five sizes of bearings listed include three outside diameters: 0.100 in., 0.0787 in., and 0.064 in.

Quick Disconnect Battery Connector

A new development in quick disconnect battery connectors particularly adapted to G-1 standard batteries conforming to AN-W-B-141 specifications



Cannon quick disconnect battery connector

has been recently introduced by Cannon Electric Development Company, Los Angeles, Cal.

Based on the screw jack principle, this new fitting speeds removal of batteries and is said to banish shorting and fire hazards. The large handwheel which turns a gear and disengages the battery is notched and easily operated by a gloved hand in sub zero temperatures. The pin contacts in the receptacle are so enclosed by its shell that they cannot touch any outside metal surfaces during removal and hence will not short.

The Receptacle No. 11749, also called the "Battery Kit" because it is affixed to the case, is made of aluminum alloy and finished with black acid-proof lacquer. The two pin contacts are leaded copper for 12-24 volt rating, 600 amperes continuous duty.

The Plug No. 11751 shell material is molded phenolic, and the handwheel aluminum alloy, having an acid-proof

black lacquer finish. Cable outlets of 1/2 in. diameter are located on both ends of the connector, with possible alternate arrangements of cables, if desired.

All-Plastic Goggle with Replaceable Lens

The Willson MonoGoggle, just brought out by Willson Products, Inc., Reading, Pa., is designed to provide



Willson MonoGoggle

high impact strength, unobstructed vision and the highest degree of comfort. The new goggle, which weighs 1 1/4 oz., has a replaceable, nonshatterable, crystal-clear plastic lens, and can be worn over any prescription glasses.

Coated Aluminum- Bronze Electrode

The Air Reduction Sales Company, New York, N. Y., announces a new coated aluminum-bronze electrode — Airco No. 100. This new, coated high tensile bronze electrode is a shielded arc electrode, and can also be used as filler rod in carbon arc welding. It will produce welding deposits of great strength and hot ductility, combined with desirable resistance to corrosion.

Deposits made with the No. 100 Airco electrode are said to be superior to standard manganese bronze with respect to corrosion resistance, and equal to it in strength, hardness and ductility.

The Airco No. 100 has a most universal application in the welding of most bronzes, malleable and cast iron or steel. In addition, it has other specific applications for which it is especially suited, such as welding manganese bronze conforming to Federal Specifications QQ-B-726b, or Navy Specifications 49-B-3e for marine propellers and other parts where great strength, ductility and corrosion resistance are strict requirements.

The Airco No. 100 can also be used for welding dissimilar metals, such as cast iron to brass, steel to malleable iron, or the joining of any two metals which are weldable with aluminum-bronze.

By L. P. Spalding,
Chief Research Engineer,
North American Aviation, Inc.

Endurance Tests Prove Quality of Gang-Riveted Joints

USE of a paper backing sheet to provide more uniform pressure distribution and decrease head flattening in gang-riveting of brazier-head rivets has been production practice for some time, but has led to some difficulty with "mushrooming" of the heads. A hollow space is left under the head of the rivet, and subsequent loosening of the rivet under vibration takes place. The mushrooming difficulty was practically eliminated by reducing the thickness of the paper. However, it is inconvenient to use the paper, and its elimination would be desirable.

In order to compare the endurance or fatigue life of joints made by gang-riveting with and without paper backing with that of joints made by hand riveting, a series of vibration tests on joints made with brazier-head rivets was carried out at the laboratory of North American Aviation, Inc. It led to the conclusion that gang-riveted joints, whether produced with or without paper backing, are entirely satisfactory and can be used in production.

Sample panels were prepared consisting of two sheets of 0.081 in. alclad 24ST aluminum alloy, measuring 6 by 7 in. and overlapping 3 in., these being riveted together by a row of six rivets spaced 1 in. apart. Riveting was accomplished by three different methods. One pair of sheets was riveted together by hand, each rivet being headed separately by means of a hand riveting gun and bucking bar. Both of the other methods involved the use of a gang riveter, with which all six rivets were headed (by squeezing) at once. In one case a heavy paper backing, approximately 3/32 in. thick, was used over the brazier heads of the rivets to prevent the flat anvil from flattening the heads, while in the other case no backing was used.

Strips 1 in. wide were cut from panels of each type of riveting, each containing one rivet. These test specimens thus consisted of an assembly of two strips,

overlapped and riveted together. These specimens were hung on the laboratory vibrating machine, two samples of each type of riveting being connected up in series, as shown by the photograph Fig. 1. One-pound impact weights were fastened to the lower

(Turn to page 133, please)

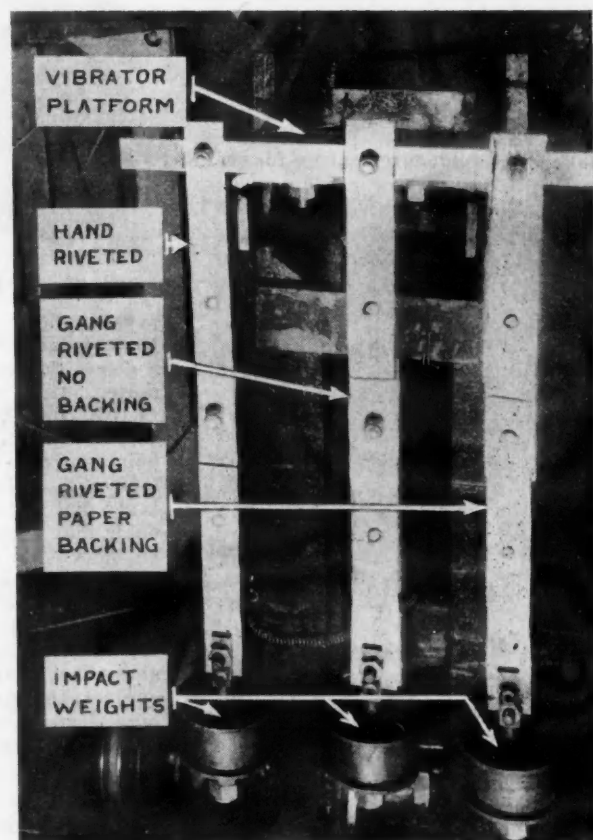
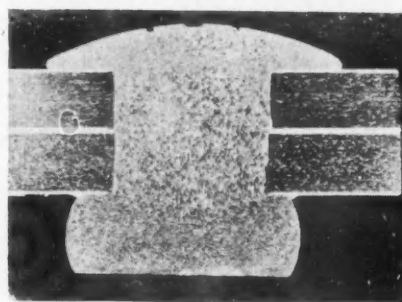
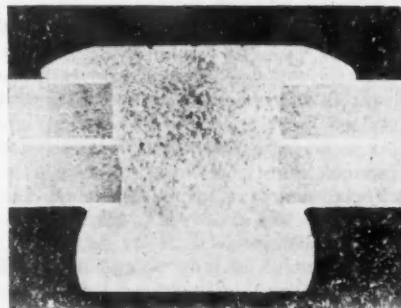


Fig. 1—Test specimens in the vibrating machine.

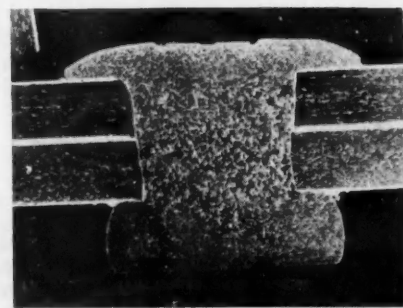
Fig. 2—Enlarged sectional photographs of riveted joints.



Hand Riveted



Gang Riveted—No Backing



Gang Riveted—Paper Backing

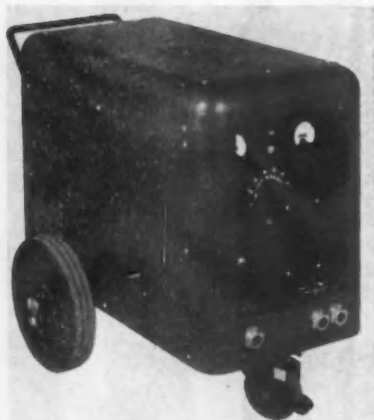


New Products for Aircraft

Engine Starter and Battery Charger

P. R. Mallory & Co., Inc., Indianapolis, Ind., offers the Mallory Rectostarter in both portable and stationary types, designed for aircraft engine starting, as a d-c power source for operating plane lights, radio and instruments while grounded, and for testing electronic equipment.

It supplies 12 or 24 volts direct current with a high surge rating for start-



Mallory Rectostarter

ing. In continuous operation, it has a rating of 100 amperes at 24 volts or 200 amperes at 12 volts. The unit can also be used for charging 12 and 24 volt aircraft batteries without removing them from the plane.

Rectostarters are available to operate from 208-230 volts a-c 3 phase circuits, or 460 volts a-c 3 phase circuits.

The portable unit is rubber tired and balanced for easy handling. Caster-type front wheel has locking device for holding unit in place when operating.

A primary tap changing switch is provided to compensate for variations in a-c line voltage and to increase d-c output for heavier loads.

Horsepower Indicator for Large Aircraft Engines

The Kollsman horsepower indicator, a product of Kollsman Instrument Division of the Square D Company, Elmhurst, N. Y., is designed to simplify the



Kollsman horsepower indicator

power control of large radial aircraft engines. This new instrument permits a direct reading of both the net horsepower output and the brake mean effective pressure from the same dial. The dial is so arranged that the same pointer gives the operator a continuous indication of bmep at all times on the inner dial and a reading of bhp on the outer dial when the correct rpm is set on the subdial.

Operating as it does from the hydraulic type torque balance units which function from the planetary propeller reduction gear, such as are now available on all large U. S. radial aircraft engines, the indicators give the operator an indication of net shaft horsepower output not obtainable in any other way.

New Hydraulic Selector Valve

Adel Precision Products Corp., Burbank, Cal., announces production of a solenoid-operated 4-way hydraulic selector valve offering advantages of light weight, greatly accelerated action and low current consumption.

Designed for aircraft installations located some distance from the flight station, such as bomb bay doors, landing gear, wing flaps, etc., where its use reduces length of hydraulic lines and effects weight savings, the new valve measures 2 3/4 in. by 2 3/4 in. by 7 3/16 in. and weighs 4.1 lb.

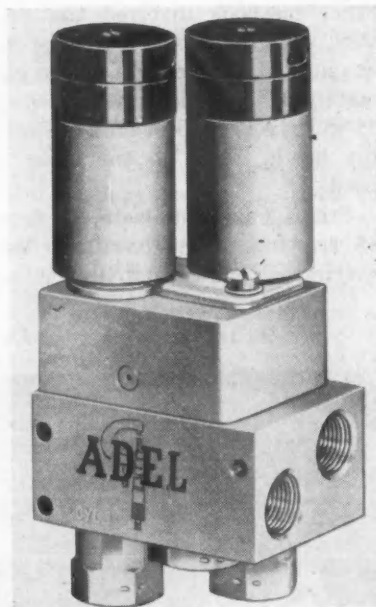
Current of 12 amp at moment of impulse automatically drops at completion of stroke to holding pull of only 0.2

amp at 24 v direct current. Body is fabricated from dural bar stock and valve has steel poppets with replaceable steel seats. A shaft is furnished for manual operation. Electrical connections are provided for either 2-wire, or 1-wire and ground circuits. Terminal posts are protected by plastic caps. Unit withstands both continuous duty and rapid cycling and operates at pressures up to 1500 psi.

Adjustable Countersink of Simplified Construction

A micro-set stop countersink of simplified construction and compact size has been placed on the market by Aircraft Tools, Inc., Los Angeles, Cal. This new Aircraft Tools model is said to offer many exclusive features such as split collet type shaft which allows the use of various cutters and pilots, full ball thrust bearing that eliminates heat and friction, simplified positive sight adjustment in increments of .002 in., lock spring in sight adjusting sleeve that holds locking teeth in set position, pin that positively locks stop collar to

(Turn to page 70, please)



Adel solenoid-operated hydraulic selector valve

Stepped Up Rate of Induction Causes New Manpower Problems

Industry, WPB and ORD Warn that Production will Suffer if Too Many Key Men are Taken from Plants

Stepping up of the rate of induction of men into the armed services and a closer review of deferments, especially of men in the 18-25 age classification, is expected to pose an additional manpower problem for automotive and aircraft plants turning out war material. There has been some conflict of government opinion on the subject, with the armed services and Selective Service seeking more men while WPB, the Office of Rubber Director and industry warn that production will suffer if too many key men are taken from the plants. Maj.-Gen. Lewis B. Hershey asserted that occupational deferments are a temporary expedient to permit employers to obtain replacements and only those draft registrants whose individual efforts in a critical activity make them virtually indispensable should be considered for such deferment.

Only about 40,000 out of 250,000 men in the 18-25 age bracket are expected to have their occupational deferments continued under the new Selective Service policy of denying deferment for such registrants unless they are individually approved by the state director of Selective Service. It is likely that these 40,000 deferments will be allotted chiefly to the newer industries in which there are a higher proportion of young technicians, such as synthetic rubber, radar and high octane gasoline, and also such highly critical programs as those for aircraft, bearings and components for landing craft. Col. Bradley Dewey, the rubber director, warned that synthetic rubber and military tire production goals would fall far short if many skilled young technicians are taken by the armed services. Extension of blanket deferments for men under 26 in the Pacific Coast aircraft industry also is likely to be critically reviewed.

Discontinuance of blanket deferments for tool and die shop employees in the Detroit area was met by statements that any general drafting of these skilled workers would cripple this industry, whose backlog is now greater than it was six months ago due to continual changes and retooling of war plants. The Automotive Tool & Die

Manufacturers Association in Detroit reported that 41 per cent, or 3,388 of the 8,416 workers employed in its 120 member shops in the Detroit area were in the 18-38 age classification and thus subject to the draft. The Detroit tool and die industry has lost 1,096 out of 9,310 male employees to the draft since March 1, 1943. Unfilled orders for more than 1,000 skilled toolroom workers have been on file with the Detroit office of the USES for the last six months.

Gen. Hershey has expressed sympathy with industry's manpower problems but asserts that the deficit in meeting the requirements of the armed

forces, which has been running behind at a rate of 100,000 men per month, must be made up if the goal of 11,300,000 men in the armed services by July 1 is to be met. He told leaders of the steel industry that they should not be dismayed if they fail to meet production quotas on account of military demands for manpower. Donald M. Nelson, chairman of WPB, voiced confidence that industry will be able to meet its production goals despite these new manpower losses.

Replacement schedules are being critically reviewed by state Selective Service headquarters with a view to releasing as many men as possible for induction without disrupting too much the operation of vital war industries. In cases of contract cancellations or cutbacks, plants are expected to lay off workers on the basis of seniority, then make available to Selective Service a comparable number of men who are eligible for the draft. As these latter men are drafted, the plants are ex-

(Turn to page 50, please)

Aircraft Engine Output Soars at Former Automotive Plants

Automobile Manufacturers have Produced 220,000 Aircraft Engines Between Pearl Harbor and March First

Automobile manufacturers have produced 220,000 aircraft engines since Pearl Harbor and up to March 1, according to the Automotive Council for War Production. These engines have aggregated 297,150,000 hp., an average of 1,350-hp. each. Largest announced production is 50,000 engines by the Allison Division of GM, while the Buick Motor Division has manufactured 35,000 engines, and the Chevrolet Motor Division has passed the 33,000 mark. Studebaker has turned out more than 30,000, while Packard and Ford both have exceeded 20,000 engines. Nash, one of the later firms to get into production, and Dodge-Chicago, which just is getting under way, are other automotive companies supplying airplane power. Continental Aviation & Engineering Corp. is tooling up its new Muskegon plant to manufacture the Rolls-Royce Merlin engine, now produced only by Packard. Meanwhile, manufacture of the 550-hp. Pratt & Whitney R-1340 engine is being transferred from Muskegon to the Continental Motors Corp. plant at Dallas, Tex.

An \$8,000,000 plant expansion program is under way at Muskegon for the Rolls-Royce project, including additional test cells. Continental expects to subcontract about 75 per cent of the Rolls-Royce work.

Chevrolet is retooling to produce a larger and more powerful aircraft engine than the 1,200-hp. Pratt & Whitney R-1830 engine which it now is assembling at North Tonawanda, N. Y., with 16 other Chevrolet plants in Indianapolis, Anderson and Muncie, Ind., Detroit, Bay City, Saginaw and Flint, Mich., figuring in the program. The new engine is the Pratt & Whitney R-2800-C, a more advanced version of the 2,000-hp. Double Wasp now being made by Ford and Nash. Production is scheduled to get under way in seven months. Some of Chevrolet's R-1830 engine manufacture probably will be shifted to other automotive plants.

Not all this U. S. aircraft engine production goes into U. S. planes. Lend-lease exports of aircraft engines and parts to the United Nations since March, 1941, have totalled more than

\$1 billion, according to the 14th report to Congress on lend-lease operations by Leo T. Crowley, foreign economic administrator. Also, the allied nations have purchased an additional \$560,000,000 worth of aircraft engines and parts from the U. S. for cash, Crowley's report showed that of the 150,000 airplanes produced in the U. S. since March, 1941, 21,000 have been sent to the Allies under lend-lease and another 7,000 have been exported and paid for in cash, principally by the British. Between March 11, 1941 and Jan. 1, 1944, 7,800 planes went to Soviet Russia, 4,000 to the allied forces in the Pacific and Far East and 16,000 to all other combat and training areas abroad. Russia received over 5,000 planes in 1943 alone, principally combat types such as the P-39, A-20 and B-25. In the nearly three years of lend-lease shipments to Russia, 4,100 tanks, 700 tank destroyers, 173,000 trucks, 33,000 jeeps and 25,000 other military motor vehicles were sent to the Soviet army. Forty thousand trucks have been furnished to India to supplement the country's railway system. Another 20,000 trucks have been shipped to Australia for the same purpose.

Disclosing Great Britain's total war output, Oliver W. Lyttelton, British production minister, recently told Parliament that 90,000 airplanes and 83,000 tanks, armored cars and gun carriers have been manufactured in British factories between the war's outbreak in September, 1939, and the end of 1943. More than 115,000 guns of over 20-mm. and 5,500,000 machine guns, rifles and other small weapons also have been produced. Seventy-six per cent of the airplanes delivered to the RAF, on an airframe weight basis, have been built in British plants, while 18 per cent were made in the U. S. and 6 per cent in the rest of the British commonwealth.

Ford Motor Company has revealed that it has been in production for many months at its two branch plants on the M-8 armored car, a six-wheel all-drive scout car weighing 7 tons. An armored hull serves as a frame for

this low silhouette vehicle which with the exception of the turret stands less than 5 ft. high. The manually operated turret mounts two fixed firing guns, a 37 mm anti-tank gun and a .30 caliber machine gun. The engine is in the rear, cradled between the wheels of the dual rear axles. The rear sets of wheels work on a bogey type suspension. The car carries a four man crew. The trend is more than 18 in. wider than a standard passenger car. It can climb a 45 per cent grade.

With production of Martin B-26 nose and center fuselage sections nearly terminated, Chrysler Corp. now is turning out center wing sections for the Curtiss SB2C-1 Helldiver Navy dive bomber in volume. Chrysler was awarded the contract for these airframe sections in March, 1942, and the

first shipments were made less than five months after the final drawings were received. Six Chrysler plants in the Detroit area participate in this program, as well as 464 subcontractors. Many machining operations are performed at the Plymouth plant, while stampings come from the DeSoto and Highland Park plants. The Dodge forge plant furnishes the aluminum forgings and final assembly is at the DeSoto and Chrysler Division plants. The mid-wing section comprises 10,000 different parts assembled into a unit 12 x 20 ft. and containing the retractable landing gear, fuel tanks and a major part of the hydraulic system. The folding wing tips are later attached to this center wing section. DeSoto has put the final assembly of these mid-wing

(Turn to page 74, please)

Output of Steel Expected to Recede from Present Levels

Restrictions Imposed by Selective Service May Add to Difficulties in Obtaining Labor for Steel Mills

By W. C. Hirsch

With Army and Navy supply plans apparently on a from-day-to-day basis because of the kaleidoscopic character of the combat in both the Italian and Pacific theatres of war, postponement of regulations to facilitate the flow of steel into the making of products for civilian needs is accepted as unavoidable. Restrictions imposed by the Selective Service act are expected to aggravate the difficulties of steel mills to obtain sufficient labor to maintain operations at recent high levels and, as a result, output is expected to recede. Sheet and plate orders, now on steel producers' order books, considerably exceed current quarter capacity and a heavy carry-over into the year's third quarter is indicated. Pressure by WPB officials on steel producers to increase their output of NE steels continues. A number of steel plants are now par-

ticipating in the supply landing craft armor plate, which calls for special heat-treating and chemical control, while others are preparing to enter this specialty field. Appointment by WPB of an Aircraft Industry Advisory Committee is being urged. It is understood that those who advocate the naming of such a body, want to see the subject of reconversion tackled without delay by industry spokesmen. Especially the light metal producers are deeply interested in whatever steps the aviation industry may decide upon to hasten reconversion. It is felt by steel and metal producers that, while the automobile industry has long pre-war experience to aid it in its approach to the reconversion problem, those in the aviation field are confronted by the new problem of how to exploit the importance that aviation gained in the war, and reconversion policies will have a paramount influence on the postwar shaping of the industry. Interest in this development is heightened by a recent WPB announcement that it has ordered reductions in magnesium output at five plants by 34,000,000 pounds. The country's rated magnesium production is 586,000,000 pounds a year, so that the cut amounts to about 6 per cent. At present magnesium output is running considerably ahead of current requirements and a two months' reserve stock has been accumulated. It is frankly admitted that military authorities have in the past overestimated their magnesium requirements. Because of limited fabricating capacity, elimination of all restrictions on the use of magnesium for civilian purposes was considered inadvisable, but for all essential needs supplies are freely available.

Army's New Armored Car

Designated the "Armored Car, M8, 6 x 6," this new weapon is said to combine the speed and maneuverability of an automobile with the punch and armored protection of a light tank. The car mounts a 37-mm cannon and a .30 cal. machine gun in a manually operated turret.



Elected Vice President of Advertising Agency

Mrs. Jean Wade Rindlaub, a copy group head of Batton, Barton, Durstine & Osborn, Inc., New York, N. Y., has been elected vice-president of the advertising agency. Mrs. Rindlaub has been with the firm for the last fourteen years. She is a director of the Advertising Women of New York.

Tiedeman Now Detroit WPB Regional Director

Carsten Tiedeman, special representative and consultant for the Gear Grinding Machine Co., Detroit, has been appointed Detroit regional director of WPB. He succeeds L. W. Welch, who had served as acting director since Nov. 1. Welch is returning to his post as president and general manager of Avery Farm Machinery Co., Peoria, Ill. Tiedeman was vice president and general credit manager of Universal Credit Co. from 1936 until Jan. 1, 1943. In that position he worked with E. C. Kanzler, first regional director of the Detroit WPB. Tiedeman is a director of the Hudson Motor Car Co.

Doss Resigns from Ford Motor Company

H. Clay Doss, southeast regional sales manager for the Ford Motor Co., has resigned. Doss had been a member of the Ford sales organization since 1916 and was general sales manager from 1939 until late 1943. "It is with great regret that we accept Mr. Doss' resignation," said Henry Ford II, vice president. "His long years of valued service have been a definite contribution to the company's progress."

American Brake Shoe Opens Pilot Plant

The American Brake Shoe Company is opening an experimental foundry at Mahwah, N. J. Instead of operating on a miniature basis, as do most pilot units, this plant is a full size foundry capable of handling castings up to 2000 lbs. gross weight. However, only experimental work will be done in this foundry.

Obituary

Joseph B. Eastman, 61, director of the ODT and a member of the Interstate Commerce Commission since 1919, died March 15 in Washington after a month's illness. Eastman became secretary of the Public Franchise League of Boston in 1906, representing employees in disputes with the street railway company. In 1915 he became a

member of the Massachusetts Public Service Commission but resigned in 1919 when he was named a member of the ICC. In the depression years 1933 to 1936 he was appointed coordinator of the nation's railroads by President Roosevelt. He was elected to a three-year term as chairman of the ICC in 1939 but had to relinquish it when he took over the added duties of ODT.

Richard H. Scott, 74, former president and general manager of the Reo Motor Car Co., died March 11 at his home in Lansing, Mich., after a long illness. Scott helped R. E. Olds found the Reo company in 1903 and remained with the company for nearly 30 years, advancing to superintendent and finally president. Since leaving Reo about 10 years ago, he had been president and general manager of the Atlas Drop Forge Co.

Niels A. Sorensen, 63, superintendent of the automotive and Diesel crankshaft division of The Ohio Crankshaft Company, Cleveland, Ohio, died March 7th of burns suffered when a small gas heater exploded in his home. He had been connected with Ohio Crankshaft since 1937.

L. S. Costley, 50, regional manager of Chevrolet's Southeast Region since 1928, with headquarters at Atlanta, Ga., died suddenly at his home in Daytona Beach, Fla., March 5. A top-ranking Chevrolet sales executive and one of the best-known members of the division's wholesale field organization, Costley had been with Chevrolet 28 years.

Jesse S. Draper, 72, one of the founders of the Hudson Motor Car Co., died March 5 at his home in Toledo. He was associated with Hudson for 25 years after its founding and served as sales manager and later general export manager.

M. E. W. A. Uses Trade Magazine Advertising

The Motor and Equipment Wholesalers Association is conducting a full coverage trade magazine advertising program to tell about outstanding war-time services of automotive wholesalers and to emphasize the importance of the wholesaler-dealer system of distribution in the efficient war-time functioning of America's millions of motor vehicles and to the maintenance of our country's free enterprise system. Information concerning the program is given in a recent release which says: "Pursuant to action by its Board of Directors, the Motor and Equipment Wholesalers Association is inaugurating the Automotive Wholesalers' Trade Magazine Advertising Program in the April and May issues of practically all of the automotive trade

papers. The program is being financed out of general funds of the Association and no assessments or contributions are asked for or contemplated. It is projected over a three-year period.



Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the March 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press:

ANACONDA WIRE & CABLE COMPANY, Muskegon Plant, Muskegon, Mich.
 ANACONDA WIRE & CABLE COMPANY, Shelby Plant, Shelby, Mich.
 BETHLEHEM STEEL COMPANY, Shipbuilding Division, Baltimore, Md.
 BLISS & LAUGHLIN, INC., Harvey Plant, Harvey, Ill.
 COMBUSTION ENGINEERING COMPANY, INC., Savannah Plant, Savannah, Ga.
 CONSOLIDATED STEEL CORPORATION, LTD., Landing Craft Division, Maywood, Cal.
 COOPER-BESSEMER CORPORATION, Grove City, Pa.
 DODGE MANUFACTURING COMPANY, Mishawaka, Ind.
 GENERAL CONTROLS COMPANY, Glendale, Cal.
 GOODYEAR TIRE & RUBBER COMPANY, Kelly Springfield Tire Company, Cumberland, Md.
 HERCULES POWDER COMPANY, Bessemer Plant, Bessemer, Ala.
 LANGLEY CORPORATION, San Diego, Cal.
 LINK BELT COMPANY, Pacific Division, San Francisco, Cal.
 SIMPLEX PRODUCTS CORPORATION, Cleveland, Ohio.
 STANDARD SCREW COMPANY, The Western Automatic Machine Screw Company, Elyria, Ohio.
 UNION FORGING COMPANY, Endicott, N. Y.
 UNITED STATES RUBBER COMPANY, Charlotte Plant, Charlotte, N. C.
 UNITED STATES RUBBER COMPANY, Naugatuck Chemical Division, Naugatuck, Conn.
 WALKER MANUFACTURING COMPANY, Main Plant, Racine, Wis.
 WALKER MANUFACTURING COMPANY, Ajax Division, Racine, Wis.
 THE YODER COMPANY, Cleveland, Ohio.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

BOUND BROOK OIL-LESS BEARING COMPANY, Bound Brook, N. J.
 THE BRISTOL COMPANY, Bristol, Conn.
 EDWARD G. BUDD MANUFACTURING COMPANY, Philadelphia, Pa.
 E. I. DU PONT DE NEMOURS AND COMPANY, Martinsville, Va.
 E. I. DU PONT DE NEMOURS AND COMPANY, Seaford, Del.
 E. I. DU PONT DE NEMOURS AND COMPANY, Pilot Plant, Wilmington, Del.
 JENKINS BROS., Bridgeport, Conn.
 SILENT HOIST WINCH & CRANE COMPANY, Brooklyn, N. Y.
 UNITED STATES RUBBER COMPANY, Mishawaka Plant, Mishawaka, Ind.
 WHITE MOTOR COMPANY, Cleveland, Ohio.
 N. A. WOODWORTH COMPANY, Farmdale, Mich.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Further moderate recession of general business activity is indicated. The seasonally adjusted index of *The New York Times* for the week ended March 11 stood at 143.2, as against 144.3 in the preceding week and 136.6 a year ago.

Department store sales during the week ended March 11, as reported by the Federal Reserve Board, increased from 144 to 148 per cent. of the 1935-39 average; and the values recorded were 11 per cent. above the corresponding figure in 1943. Sales in 1944 to date, however, are one per cent. less than the total a year earlier.

Railway freight loadings during the week ended March 11 totaled 781,533 cars, 0.9 per cent. fewer than the preceding weekly figure but 1.06 per cent. above the comparable number in 1943.

Production of electric power during the same period declined, contrary to the usual seasonal trend; and the total was 12.2 per cent. above the output a year ago, as against a similar excess of 13.1 per cent. shown a week earlier.

Crude oil production in the week ended March 11 averaged 4,381,175 barrels daily, 31,550 barrels below the figure for the preceding week, but 12,875 barrels more than the average recommended by the Petroleum Administration for War.

Production of soft coal during the week ended March 4 was estimated at 12,050,000 net tons, 4.2 per cent. below the preceding weekly figure; but for 1944 to date, output is 4.9 per cent. greater than the comparable total a year earlier.

Engineering construction contracts awarded during the week ended March 16 totaled \$29,415,000, as against \$44,579,000 a week earlier, according to *Engineering News-Record*. Contracts so far reported in 1944 show a decline of 49 per cent. from the corresponding amount in 1943.

The Irwin Fisher index of wholesale commodity prices for the week ended March 17 was 112.9 per cent. of the 1926 average, marking a gain of one fractional point for the period and comparing with 111.7 a year ago.

Member bank reserves increased \$322,000,000 during the week ended March 15, and excess reserves rose \$300,000,000 to an estimated total of \$1,300,000,000. Business loans of reporting members declined \$25,000,000 in the preceding week but stood \$339,000,000 above the total a year earlier.

PERSONALS

Appointment of **John W. Kelly** as chief engineer of **Adel Precision Products Corp.**, Burbank, has been announced. Mr. Kelly was previously assistant chief engineer.

The **Fram Corp.** of Providence has announced that **Malcolm McCormick**, who has been with the company for the past three years as vice-president of the War Production Div., has been promoted to the position of Vice-President in Charge of Sales.

Harnischfeger Corp., Milwaukee, has announced the appointment of **E. W. Potratz** as manager of the **Holst Sales Div.**, and **J. D. Glatz**, recently returned from Washington after two years with the WPB, as head of its newly established repair parts division.

W. H. Stevens has been named regional

manager of **Studebaker's Cleveland Branch**.

Westinghouse Electric & Mfg. Co. has announced the following personnel changes: **Frank R. Benedict** has been appointed manager of product performance analysis; **William E. Miller** has been named general attorney in charge of the company's Law and Patent Dept., and **William D. Turnbull**, until recently vice-president and sales manager of the **Pomona Pump Co.** of California, has been appointed manager of the Agency and Specialties Dept. **Ira B. Stiefel** has become assistant to the vice-president in charge of Industrial Relations.

The **S. K. Wellman Co.**, Cleveland, has announced the appointment of **Malcolm S. Adler** as automotive division manager, with headquarters at Detroit. He succeeds **John H. Dedrick, Jr.**, who is now engaged in special powder metallurgy research for the Wellman organization.

The **Sheffield Corp.** has announced the promotion of **John P. Bernard** to vice-president and general manager.

Fruehauf Trailer Co. has announced the appointment of **Roy A. Fruehauf** as executive vice-president.

Alva W. Phelps, formerly assistant vice-president of **General Motors Corp.**, has been elected president of the **Oliver Farm Equipment Co.** **Cal Sivright**, former president of **Oliver**, has been elected chairman of the board and chief executive officer.

Neil C. Hurley was elected chairman of the directors of the **Independent Pneumatic Tool Co.** and **Neil C., Jr.**, has been elected president of the company. **Edward G. Guftafson**, treasurer, and **John McGuire**, secretary, were elected to the board of directors.

Appointment of **Henry Kerr** to handle aircraft sales engineering activities has been announced by **Hayes Industries, Inc.**

John F. Robb has been appointed manager of the Pittsburgh district of the **Climax Molybdenum Co.**

The appointment of **Karl Schick** as sales manager of the newly formed **Railway Controls Div.** of the **Minneapolis-Honeywell Regulator Co.** has been announced by the company.

Daniel C. Green has been elected board chairman of **The Cleveland Pneumatic Tool Co.** and its subsidiary, **Cleveland Pneumatic Aerol, Inc.** **George P. Torrence** has been elected president.

Harry W. Kaley, formerly general sales manager, has been elected a vice-president of **Ethyl Corp.** Mr. Kaley will act principally as coordinator for the company. **Julian J. Frey** of Detroit, formerly manager of the technical service dept., will succeed him as general sales manager.

Henry E. Hermann has been appointed works manager of the **Bear Mfg. Co.**, Rock Island, Ill., in charge of all production.

Cardox Corp. has announced the appointment of **J. Paul Oliver** as administrative technical assistant of the research division. **Dr. Lawrence M. Liggett** succeeds Mr. Oliver as plant superintendent and **Dr. James A. Taylor** has joined the research division as chemical engineer.

R. V. Hessler has resigned as advertising manager and sales representative of the **Spicer Mfg. Corp.** and is now associated with **Timken-Detroit Axle Co.**

Frederick P. Culbert, recently resigned American Vice-Consul at Casablanca and French representative for the **United Aircraft Corp.**, has been appointed general manager of the **Al-Fin Corp.**, a subsidiary of the **Fairchild Engine and Airplane Corp.**

Harry M. Heckathorn has been elected vice-president in charge of production of **Mullins Mfg. Corp.'s** Salem and Warren plants.

Millard F. Shryer, formerly sales manager of **Motive Parts Co.** of America, Inc., and Manager of the Wholesale Sales Dept. of the **Wayne Pump Co.**, has joined the staff of Motor and Equipment Wholesalers Assoc. as national field representative and secretary of committees.

The **Osborn Mfg. Co.'s** foundry machine div. has appointed **Leon F. Miller** as sales manager, succeeding **R. F. Incoin**, resigned.

James Cope, formerly manager of the **Washington Reporting Service** for the **Automotive Council for War Production**,

has been appointed assistant to the president of **Chrysler Corp.**

Ottar M. Dahl, formerly West Coast service manager, has been appointed assistant general service manager of the **Pontiac Motor Division** of **General Motors Corp.**

CALENDAR

Conventions and Meetings

American Chemical Society, Cleveland,	April 3-7
SAE Natl. Aeronautic Meeting, New York	April 5-7
Midwest Power Conference, Chicago,	April 13-14
American Chemical Society Spring Mtg. of Div. of Rubber Chemistry, New York City	April 26-28
Institute of the Aeronautical Sciences—Natl. Light Aircraft Mtg., Detroit,	April 27
SAE Natl. Diesel-Fuels & Lubricants Meeting, Chicago	May 17-18
SAE Natl. War-Materiel Meeting, Detroit	June 5-7
American Society for Testing Materials (47th Annual Meeting), New York City	June 26-30
SAE Natl. Transportation & Maintenance Meeting, Philadelphia	June 28-29
SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, Oregon	August 24-25
SAE Natl. Tractor Meeting, Milwaukee	Sept. 13-15
SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles	Oct. 5-7
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 9-10
SAE Natl. Air Cargo Mtg., Chicago,	Dec. 4-6
SAE Annual Meeting, Detroit	Jan. 8-12

Advertising Notes

William F. Pitney has joined **MacFarland, Aveyard & Company** as vice-president and account executive, according to an announcement by **Hays MacFarland**, president.

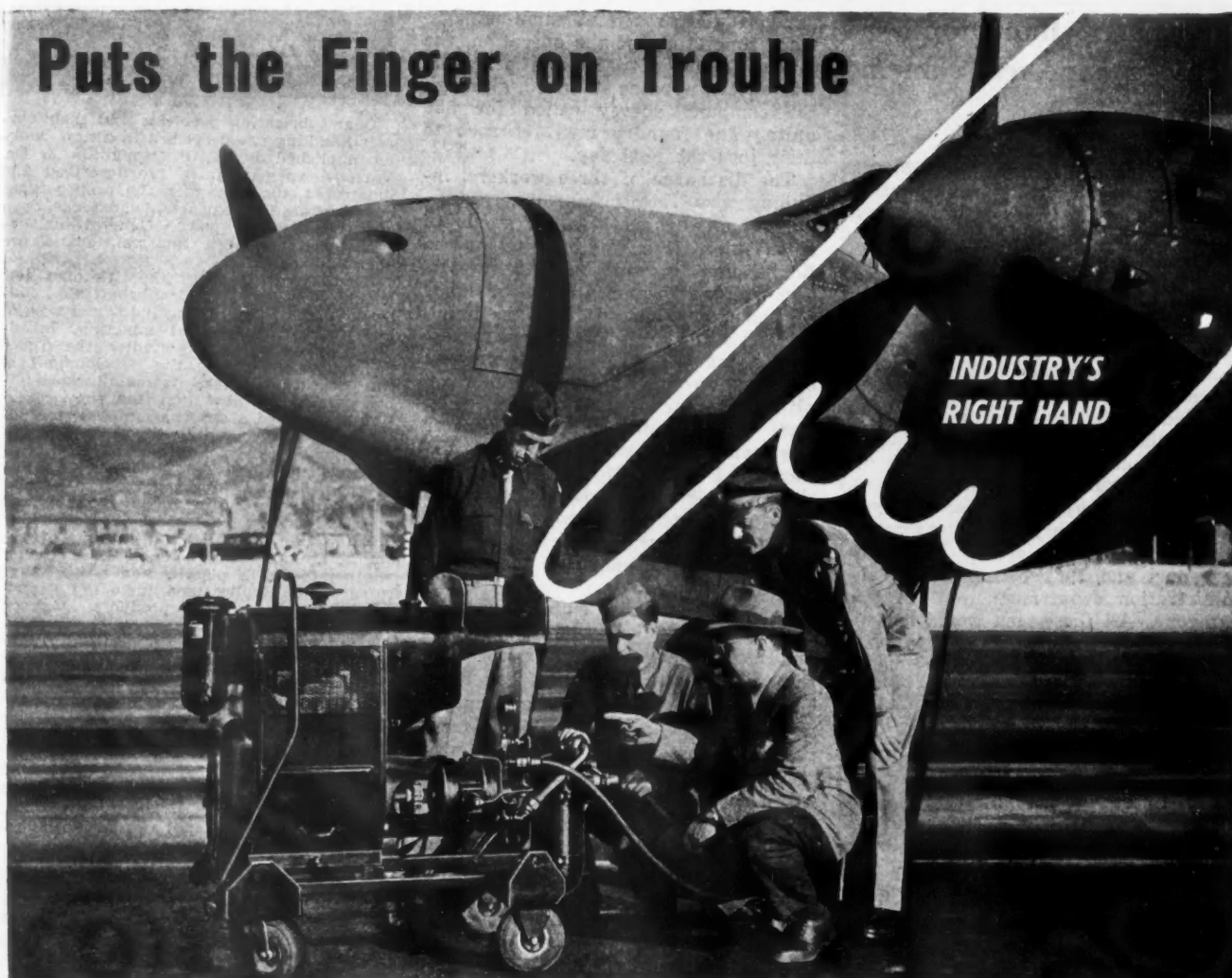
Mr. Pitney's is the fourth new major executive position to be filled by the agency since the beginning of the year. The firm has added additional space to the home office to accommodate the increased business handled by the various departments, Mr. MacFarland said.

WPB is Forming an Automobile Industry Advisory Committee

The War Production Board is forming an Automobile Industry Advisory Committee composed of the top-ranking official in each company that manufactured passenger cars at the time production was frozen by government order.

This committee will meet with WPB officials in Washington about the middle of April to explore the basic problems that must be dealt with by industry and government as a preliminary to the eventual resumption of passenger car production. Its purpose is entirely exploratory and advisory on the part of both industry and government.

Puts the Finger on Trouble



INDUSTRY'S
RIGHT HAND

OFFICIAL PHOTO SBASC TRAINING CENTER, SAN BERNARDINO, CALIF.

Hydraulic Circuits Accurately Ground-Tested

The gasoline-engine-powered Hydrollic Test Stand shown above, and the electric-motor-driven unit below, test aircraft hydraulic systems at pressures up to 3000 psi.

If any "bugs" have developed in the hydraulic circuit of the plane above, the Hydrollic Test Stand in the foreground will put the finger on them before they cause trouble. It makes quick, thorough tests of the fluid power lines to ailerons, elevators, rudders, wing flaps, landing gear, propeller-feathering mechanism, bomb-bay doors—and all hydraulically operated parts a plane may have. Powered by a gasoline engine, it can be used anywhere in the field. (The motor-driven Hydrollic Test Stand at left, below, does the same job wherever standard electric current is available.)

To make these tests, connections to the plane's hydraulic pump and its system are simply changed over to the test stand . . . and tests can be made at various pressures up to 3000 psi without operating the plane's engine, or engines.

Supplying ground-test equipment which accurately tests hydraulic systems, spark plugs, hydraulic propellers, and magnetos is only one of the ways Hydrollics has a hand in Aviation. Hydrollic presses and other types of Denison Oil-Hydraulic equipment are used in the production and assembly of aircraft and aircraft parts. And, Hydrollic Fuel Valves are used in many of today's planes.

Check on how Hydrollics can serve you.

The DENISON Engineering Company, 1178 Dublin Rd., Columbus 16, Ohio



DENISON
EQUIPMENT *in* APPLIED
Hydrollics

Stepped Up Induction Causes Manpower Problems

(Continued from page 45)

pected to rehire the laid off employees. However, this may often be impractical as the laid off workers seek employment elsewhere or are not immediately available. But in the interest of labor peace the government is requesting that plant seniority lists be respected.

A survey of the Pacific Coast aircraft industry last summer showed that seven companies had 21,000 employees in key departments who were married without children or single and within the 18-38 age bracket. Thirty-seven per cent of the engineering department personnel of these companies, 24 per cent of the key tooling employees, 23 per cent of inspection department heads, 17 per cent of the key plant personnel and 16 per cent of the administration department were in this category. All these men would be vulnerable to the draft by June, 1944. Now with pre-Pearl Harbor fathers being drafted, the number vulnerable to induction presumably would be greatly increased.

A survey made in February disclosed that 6 per cent or 19,000 of the West Coast aircraft industry's employees are men in the 18-25 age group subject to the new more drastic draft regulations. However, the industry will seek further deferment of these men only in those cases where the men are of extraordinary value to production either through formal education or many years of training and shop work, or both.

First crackdown of the UAW-CIO on members who cause unauthorized work stoppages was evidenced recently when the Ford Motor Co., fired 26 employees and suspended 48 others for periods from four days to four weeks, with union approval, for their participation in three wildcat strikes and labor disturbances at the huge Rouge plant. In complying with the new international union policy, the officers of Local 600 reviewed the cases of all members involved in the trouble. As a result of the local's investigation, 16 of the 121 workers disciplined by the company for alleged participation in the strikes were reinstated with back pay and the penalties against 27 other workers were reduced. Of those fired, 11 were temporary employees, five were probationary workers and 10 had seniority standing.

First of the latest series of incidents at the Rouge plant occurred when 1,000 employees in the production foundry walked out after nine workers in the core room were called upon by the company to explain why they were not meeting production schedules. Another walkout had taken place six weeks previously when workers protested disciplinary action by the company after output per worker fell to 275 units

per shift. After a joint union-management time study of the operation, the union's figure of 515 units per shift was agreed upon as standard, although the company survey called for 566 units. The foundry men returned to their jobs the next day.

The discharge of three workers, including two former marines, precipitated a disturbance by 250 employees in the aircraft engine building at the Rouge plant in which a plant protection man was beaten up, a Ford labor relations man chased from the building and a labor relations office wrecked. The ex-marines, who the union said had gone through the "horrors of war," although their records showed they were given medical discharges after less than a year's training in the U. S., were fired by Ford for a second violation of no-smoking regulations. Ten men, including six plant committeemen, were fired, with union acquiescence and 10 more suspended as a result of this disturbance.

A week later some employees on the afternoon shift left their jobs early and blocked the plant entrance with their cars, preventing more than 2,000 out of 5,400 employees on the midnight shift in the aircraft building from reaching their jobs. This was in protest over the disciplinary measures taken by the company against those involved in the previous disturbance. A similar automobile barricade was established the next morning, preventing more than 5,000 workers on the day shift at the Rouge plant from reaching their jobs and retarding production of 2,000-hp. aircraft engines. The cars finally were removed with the aid of Dearborn police and union officials, who condemned this action by "irresponsible" members. More than 100 participating workers were disciplined by the company as a result of this gate blockage, with tacit union approval.

After the disturbance, R. J. Thomas, president of the UAW-CIO, said, "The union will not retreat from its decision to enforce its war-time no-strike pledge and the provisions of its constitution. On the other hand, the union will not give and does not give blanket right to the Ford Motor Co. or any other company to fire whomever it wishes to fire."

Meanwhile, the Army Air Forces announced that production of vitally needed aircraft engines is behind schedule at the Ford Rouge plant.

Adams to Represent Arrow in Canada

All Arrow Safety Device Co. business in Canada will now be handled by J. C. Adams Co., Limited, 115 George Street, Toronto. This concern is well known throughout Canada as a distributor of automotive and industrial supplies.

PUBLICATIONS

Gear lubrication problems and their correct handling are described in a new booklet published by E. F. Houghton & Co. Various types of gears are described and illustrated, together with the proper types of lubricants for gear sets, headstocks, open gears and worm gears. General instructions on proper lubrication maintenance are also included.*

Results with Tocco is the title of a new booklet by The Ohio Crankshaft Co., featuring sixteen interesting industrial uses of high frequency electrical induction. In addition to various case studies the Tocco booklet briefly traces the development of the process, describes its metallurgical effects and shows how high frequency induction has played a vital part in war production and can be easily adapted to postwar conditions when that time comes.*

The Chemical Div. of The B. F. Goodrich Co. has issued a four-page folder describing a unique group of polyvinyl resins and plastics recently developed by the company. A page is devoted to an outline of the characteristics of the four GEON resins, another to GEON plastics and a third page to suggested applications, including electrical service, extruded products, gaskets, etc.*

A new booklet has been issued by Aluminum Co. of America, called **Aluminum Imagineering Notebook**. It contains twelve economic advantages of aluminum, a chapter being devoted to each of the twelve advantages—and is profusely illustrated throughout.*

A vest pocket catalog, presenting the full line of **Clark Tractors**, has been issued by Clark Tractor Div. of Clark Equipment Co. It is illustrated and has specification data on each model.*

A 28-page booklet entitled **Care and Maintenance of Electrical Equipment** has been issued by Square D Co. It contains instructions for keeping switches, panel-boards and switchboards in good operating condition.*

Hydraulic Torque Converters is the title of a new 16-page booklet issued by Twin Disc Clutch Co. Several models of its Hydraulic Torque Converters are described in detail and illustrated by photographs and drawings. Installation data is also included.*

A new bulletin released by Surface Combustion describes and illustrates the **whirl flame** operating principle of the new Surface Combustion type **Janitrol** high altitude aircraft heater. Included are cutaway drawings showing details of the heater. Other drawings illustrate the installation of the heaters in large and small planes.*

Catalog No. 44 has been issued by Wetmore Reamer Co. It contains descriptions, illustrations, specifications and prices of **reamers and boring bars** and contains several pages devoted to special tools, designed and manufactured for specific operations.*

Stow Manufacturing Co. has issued Catalog No. 40A on its **flexible shafting**. Included are descriptions and illustrations of various models, together with specifications and applications.*

The Baker Industrial Truck Div. of The Baker-Raulang Co. has issued a new catalog, No. 52. It is a handbook of information on **material handling with power trucks**, designed to facilitate selection of the proper equipment for any set of requirements.*

Illustrated with many photographs showing both the repairs to be made and the methods for making them, The B. F. Goodrich Co. has just published a service bulletin on **Repairing Synthetic Tires and Tubes**.*

* Obtainable by subscribers within the United States through Editorial Dept. **AUTOMOTIVE and AVIATION INDUSTRIES**. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

What will Users Want from POSTWAR Machine Tools

4 BETTER FINISH

Among competing products, the one having the best machined finish almost always has the advantage—other things being nearly equal. It is a natural human trait to associate good finish with good quality.

And, experience with airplane engines has shown that finish is frequently important even when not visible. Airplane engine builders do much careful finishing on parts that are rarely seen . . . because it has been found that finish is a powerful factor in eliminating fatigue cracks, hence fatigue failure.

By equipping machines with Vickers Hydromotive Controls, better finish can frequently be obtained without added cost and without extra operations. For example, smooth and uniform feeds can be secured regardless of variation in work resistance or hydraulic pressure. Vibration, backlash and override are usually easily eliminated . . . smooth reversals and constant cutting speeds on varying contours are also readily obtainable.

Better finish is only one of many advantages obtainable with Vickers Hydromotive Controls. Let Vickers Application Engineers discuss them with you.

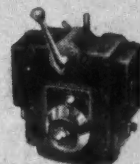
VICKERS Incorporated
1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices:
CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK
PHILADELPHIA • ROCKFORD • TULSA • WORCESTER

Representative of
More than 5,000
Standardized
VICKERS UNITS
for Every Hydraulic
Power and Control
Function



CONSTANT DELIVERY PUMPS



CONTROL ASSEMBLIES



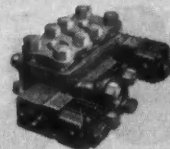
VARIABLE DELIVERY PUMPS



FLUID MOTORS



VOLUME CONTROLS



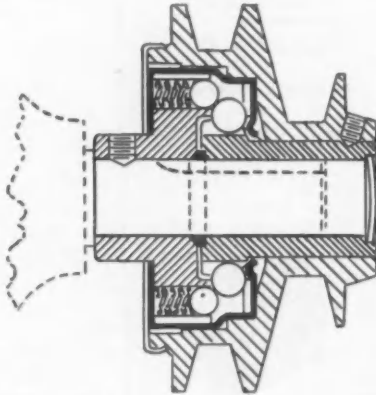
DIRECTIONAL CONTROLS



PRESSURE CONTROLS

Automatic Release Clutch

The A. Y. Dodge Co., of Rockford, Ill., has developed an automatic safety coupling which is reported to release completely when overloaded and re-



engage automatically when the power is shut off. It is stated that various degrees of overspeed protection can be incorporated in this design, including a clutch which disengages completely at excess speeds and automatically re-engages at some reduced speed.

Tests indicate that the coupling, which incorporates self-aligning features, will run indefinitely in the released state without internal injury. When the driving balls are forced outwardly, a change takes place in the angles of force.

The device is designed in two forms—as a shaft coupling and as a safety sheave, which is illustrated here in cross-section. A coupling for one horsepower at 1200 rpm has a shaft diameter up to one in., an outside diameter of 3 3/4 in. and a length of 3 1/4 in. for various sizes, their capacities vary as the cubes of their diameters.

New Production Equipment

(Continued from page 38)

radius grinding of mounted carbide tips.

Included in the line of Abrasive diamond wheels are all popular sizes and most widely-used types. In addition to straight, pointed and rounded types with diamonds in the periphery, there are also plain cup, flaring cup and dish types with straight or beveled insides. Hand lapping hones with diamonds at either one or both ends are also available from Abrasive. Facilities are available for the production of diamond wheels in special shapes and sizes to customer specifications.

VARD, INC., Pasadena, Cal., now offers for inspectors a streamlined stand which will securely support a roll



Vard roll thread snap gage stand

thread snap gage in an easy working position.

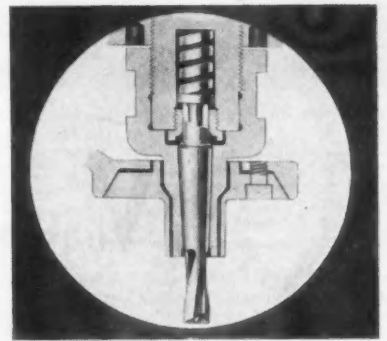
The stand retains the gage by means of an Allen head socket screw, and in the larger types (GSA Model) by an additional bearing plate which engages the wide machined pads on the Vard snap gage frame.

This stand gives the inspector the opportunity to use both hands on the work to be checked. It also eliminates the possibility of gage distortion, which occurs when the gage is held for a period of time in direct contact with body heat, as would be the case when the gage is in the hands of the operator.

These bench inspection stands are made in two types. Model GSC, which is 4 1/2 in. long, 3 in. wide, 3 1/4 in. high and weighs two pounds, is made to handle the Vard OC, Vard John-sons Roll, and VC snap gages which check number series threads. Model GSA, which is 6 5/8 in. long, 3 1/2 in. wide, 3 1/2 in. high and weighs five pounds, handles Vard type OA, OB, Vard John-sons Roll, VE, and VF snap gages which check threaded parts in diameters up to thirteen inches.

PERFORMANCE of radial arm routers, used for high speed production of nonferrous at sheet parts, is said to be improved by the use of the Onsrud inverted taper friction chuck made by Onsrud Machine Works, Chicago, Ill. This chuck permits gripping of router bits immediately adjacent to the cutting edge.

Use of the taper chuck counteracts



Onsrud inverted taper friction chuck

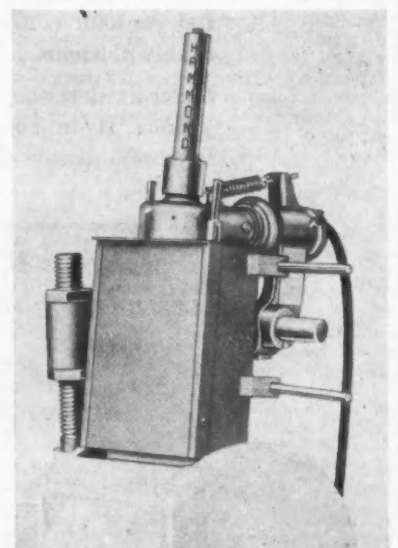
the effect of side thrust developed by cutting pressure very effectively and, as a result, bit breakage is held to a minimum. Precision machine taper of chuck and bit shank assures axial alignment and proper centering of tool at all times.

A spring and pin unit are employed to maintain pressure on the end of the router bit, causing the tapered surfaces of the bit and chuck to grip so tightly that slippage cannot occur.

AN AUTOMATIC air-operated cylindrical and rectangular composition applicator for use on any type of polishing and buffing machine has just been placed on the market by Hammond Machinery Builders, Inc., Kalamazoo, Mich.

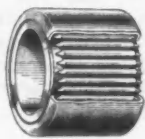
This new composition applicator known as the Hammond Auto-Doper can be used for either cylindrical or rectangular bars by changing the composition housing for the type of bar required. The Hammond Auto-Doper is operated by compressed air and the frequency of operation is controlled by an air valve operated from a cam, electrical timer or foot valve as the requirement may indicate.

Hammond cylindrical Auto-Doper

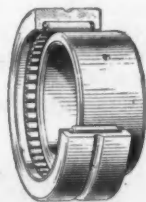


Hammond Auto-Doper

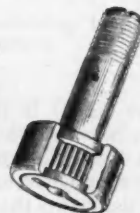
How Design of Needle Bearings Aids Efficient Lubrication...



Three of the DC Type Torrington Needle Bearings show how the turned-in lips of the hardened retaining shell provide a natural storage reservoir for retention of the lubricant.



In the NCS Type Needle Bearing, the construction of the heavy outer raceway also provides a similar design feature to aid in efficient lubrication.



The RC Type Needle Bearings illustrated here show how these enclosed cam-follower type bearings will hold the lubricant within the bearing and how the design helps to *exclude* dust and dirt.

THIS FEATURE PROMOTES DESIGN SIMPLIFICATION; PROLONGS SERVICE LIFE; REDUCES MAINTENANCE

An outstanding feature of Torrington Needle Bearings is the ease and efficiency with which they are lubricated... a factor contributing to many advantages which the design engineer will quickly appreciate.

For example, the cut-away sections of the Torrington Needle Bearings illustrated here clearly show how the cupped or closed retaining shells which hold the full complement of needle rollers also provide a natural reservoir for retention storage of lubricant. Thus as the rollers rotate around their own axis and travel in a circle around the shaft, they are continually supplied with an oil or grease film.

So efficient is this simple method of lubrication that many applications have been made in which the lubricant provided in the bearing on installation lasts for the life of the equipment. (The limiting factor is usually the life of the lubricant.)

However, in any given layout or application, the design and service requirements will determine the method

of lubrication as well as the type of lubricant.

All Torrington Needle Bearings are lubricated before shipment to protect them in transit and in storage. A high grade mineral base slushing compound is regularly used. It has good lubricating qualities at ordinary temperatures and should be left in the bearings on installation in applications where they will be lubricated along with adjacent parts as in gear cases, transmissions and similar locations.

Where operating conditions—load, speed, and temperature—call for another type of lubricant, Torrington Needle Bearings are supplied prepacked with lubricant to customer specifications if requested.

From long experience with hundreds

of different applications, Torrington's Engineering Department will gladly advise on selecting the method best suited to the requirements of your use of Needle Bearings. In this way you are assured long life and an installation which will require a minimum of maintenance or service attention.

Further information on this and other advantages of these compact, high capacity anti-friction bearings will be found in our Catalog 107. Send for your copy today.

THE TORRINGTON COMPANY

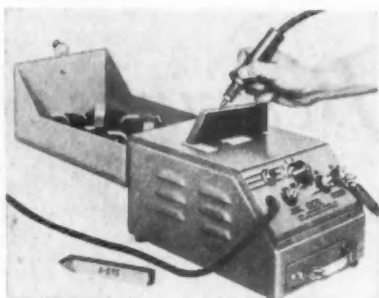
Established 1866 • Torrington, Conn. • South Bend 21, Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"

New York	Boston	Philadelphia
Detroit	Cleveland	Seattle
San Francisco	Chicago	Los Angeles
Toronto		London, England



TORRINGTON

NEEDLE BEARINGS



Ideal combination etcher and demagnetizer

(Type ADC) is for cylindrical composition bars up to 2½ in. diameter and 10 in. long. The composition bar is partially rotated at each stroke which permits using up the full diameter of the bar regardless of the width of wheel.

Hammond rectangular Auto-Doper is for composition bars 2 in. by 2 in. and up to 2 in. by 12 in. wide and 10 in. long, for applying composition to wheels from 2 in. to 12 in. in width.

THE Ideal Commutator Dresser Company, Sycamore, Ill., has developed a tool that is ready for instant use as either an etcher or demagnetizer. Small tools or parts to be etched may be placed directly on the work-plate. A ground clamp is provided for parts too large for the work-plate.

Fourteen heats (Lo-90, 150, 200, 250, 350, 450, 600; Hi-300, 400, 500, 650, 850, 1100, 1350 watts) are provided by "Hi-Lo" tap and 7 point switch. This gives a wide range for marking all iron, steel and their alloys from small delicate parts up to large smooth castings. When using ground clamp to etch large parts, the "keeper" must be removed from front of case and placed on work-plate across transformer poles. An indicating lamp glows brighter as each higher heat is used.

To demagnetize, the switch is turned "on" to either No. 1 or No. 2 position, after which the procedure is the same as with an ordinary demagnetizer. Maximum rating is 5½ amp. Overall pole area is 13½ sq. in.

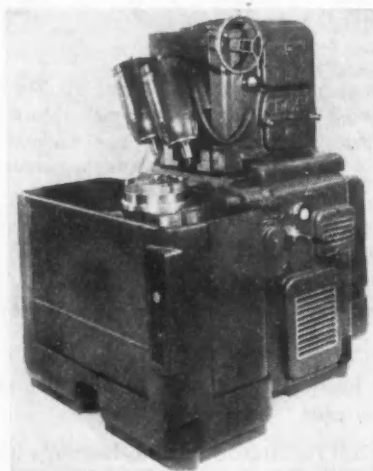
CHARLES H. BESLY AND COMPANY, Chicago, Ill., have brought out two new grinders, No. 253 and No. 926. The No. 253 is a 42-in. horizontal double spindle grinder. It is designed to rough grind and semi-finish grind parts having an approximately equal area on parallel surfaces. A wide range of work can be ground on this machine when equipped with various types of fixtures. Among the fixtures are: semi-automatic roll feed, semi-automatic rotary fixtures with multiple station solid or segmental feed wheels, power oscillating fixture and hydraulic reciprocating planer type table mounted on base between grinding wheels, to which can be attached workholding fixtures.

The machine comes equipped with a vertical bar type wheel dresser, power driven with automatic reversing

switches and push button control and a dresser bar to accommodate diamonds or star cutters.

The No. 926 is a 30-in. double vertical spindle grinder designed to finish grind parts having an approximately equal area on parallel surfaces, such as piston rings, thrust washers, rotary pump vanes, precision instrument parts and other similar work pieces. It is said that such work can be finish ground to a high degree for dimension, parallelism, uniformity and surface finish. The machine is not intended to remove a large amount of stock but rather small amounts at high feeding speeds. The abrasive wheels are usually fine grain, 120 to 320 grit.

Wheel dressers furnished with the



Besly No. 926 grinder

machine are power driven, push button controlled in main panel, with adjustable diamond holders.

Work feeding mechanism is of the semi-automatic magazine type, equipped with quick change endless feed chains. Multiple station rotary feed wheels mounted on vertical fixture spindle can also be furnished.

A NEW hydraulic multi-grip milling machine chuck is made available by Aerco Corporation, Hollydale, Cal. The Aerco Multi-Grip chuck has two rows of five collets. As both rows of parts may be milled simultaneously, ten parts may be milled with one loading. The hydraulic hand pump supplies the necessary pressure for closing all collets simultaneously, building up pressure to as much as 2500 psi. Clamping pressure may be instantly released when desired and the self-opening collets can be quickly re-loaded.

An automatic safety stop prevents damage to collets should all stations not be filled. The collets have a taper at each end, which increases the applied pressure far beyond that which is needed for successfully holding the work.

An adjustable depth stop is provided for each collet which makes it possible for the operator to insert the pieces to



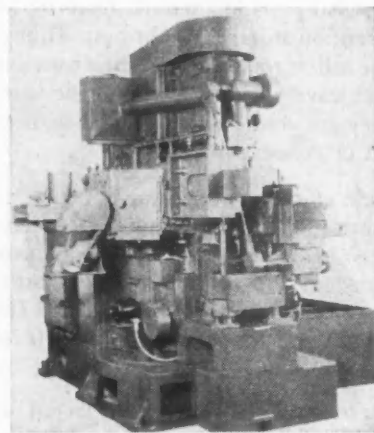
Hydraulic multi-grip milling machine chuck

be milled at the exact required amount without the use of gages or other methods. The pump, valves, pressure gage, depth gage and collet assemblies are all incorporated in the main body of the chuck itself.

THE Cross Company, Detroit, Mich., recently completed a special milling machine for an aircraft engine manufacturer. This special purpose machine is used for milling notches on each side of 12 drilled holes in a retainer ring. To accomplish it, the Cross design makes use of a unique operating cycle to complete 48 pieces per hour at 80 per cent efficiency.

The new machine is equipped with a rotary table which indexes automatically as the cutters are retracted vertically upward after each cutting operation. Duplex cutter spindles and slides are mounted in a fixed angular position on a vertical slide. Shell motors are in self-contained spindle heads, and the cutter spindles serve as motor shafts. Power traverse automatically retracts the column to clear the rotary table for loading.

In operation, the work is held in a power clamping fixture, and power traverse moves the column forward until the cutters are in position. A cam motion reciprocates the cutters vertically, synchronizing this motion with the automatic indexing of the piece. After the holes are slotted, the cutters move to the upward vertical position, and the column retracts to loading position, where the machine automatically stops.



Cross special milling machine

There are many GOOD THINGS



AHEAD...

Transparent plastic cells will make easier the checking of storage battery solutions.

A new coating for metal is claimed to have five times as much resistance to salt spray as galvanizing.

A chemical substance, added to hard nickel alloys, is claimed to save 75% of machining time.

With the promise of an infinity of electronic tube applications, the effect of their radiation on humans is being carefully studied. There seems to be no evidence of ill effects from even long exposure.

The new thyatron motor control, which makes possible the operation of D. C. motors from A. C. current supply, is said to permit exact variations in speed from 25 to 1,750 r.p.m. by the turning of a graduated knob.

Many new kinds of ink have been developed for war needs, including one that is oil-proof which is used to print instructions on mechanical parts. Another prints the lines on gun sights and surveyors' instruments for which spiders' webs were formerly used.

A new series of plastics containing silicon has very great resistance to heat.

The old "lost wax" process of casting, long a method of jewelry manufacture, has been revived for the making of small, complex mechanical parts.

A small section of Connecticut highway is being paved experimentally with steel mat similar to that used for quick construction of landing fields and on invasion beaches.

A new high-speed X-ray inspection machine is claimed to be capable of photographing as many as 17,000 castings per hour on a continuous film.

A new landing gear, for aircraft, works on the caterpillar principle, and is said to be lighter than the conventional wheels with from four to eight times the supporting surface.

A new cement that may be applied with a brush and set with a flat iron is claimed to bond metals with a strength and permanence equal to spot welding.

In one of the trickiest of new finishing processes, the sprayed paint coats one side of an object and, after passing by it, turns around and returns to paint the other side.

Broken drills and reamers are being removed from holes with dynamite.

A new 120-inch searchlight, with 900-watt mercury light source, develops 7,500,000 candle power.

So many uses are anticipated for glass fibers that they are being produced in seven standard types. Their fibers are now being used in making filters and insulation, for reinforcements in felt, paper, plastics and alone, or in combination, with cotton, rayon or asbestos in textiles.

A new method of checking liquids during processing depends on the observation of color by a photo-electric colorimeter.

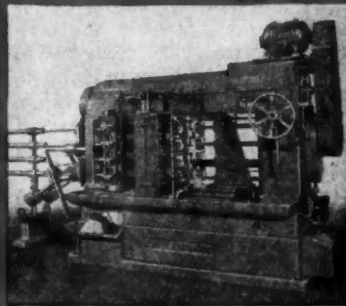
Aircraft piston rings finished with oil-retaining, porous chrome plate are reported to increase by five the flying time between overhauls.

A new "wide-angle photo-electric scanner" is offered as an inspection or safety device. While the work that it does is similar to that done by more familiar applications of the "electric eye", the new device scans the whole of an area, such as a sheet of paper or the space in front of a machine. Any change occurring in the area produces a reaction that may be used to give a warning signal or shut off power.



*When
you think ahead,
think of
production like this*

These four tension bolts are all made at once, automatically, in twelve seconds — three seconds each — on the one-inch 4-spindle Vertical Conomatic. Production like this has helped America to overcome the time advantage of its enemies in war, and will help American manufacturers to overcome competition in time of peace.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

Production Problems of Exhaust Collector Rings

(Continued from page 27)

seam welding (Fig. 6 on page 26).

Heat treating, the next step, was the concern of the Chief Inspector's office, which was successful in improving on the original specifications. Instead of 1650 deg. for a half hour, it was successfully demonstrated that a temperature of 1950 deg. from five to eight minutes gave better results.

Moreover, where production elsewhere had been scheduled to include (1) a draw, (2) a heat treat, (3) a re-draw, (4) another heat treat, (5) a weld, (6) a third heat treat, (7) straightening, and (8) a final heat treat, operations at American Central have been so simplified that only a few steps are necessary—(1) a draw, (2) weld, (3) preliminary straightening, (4) a single heat treat, and (5) final straightening. This procedure, of course, requires a draw held to the extreme accuracy of plus or minus .002 in., but has the great advantage of saving considerable time and handling.

Collector ring sections are loaded into the heat treat furnace by means of a loader operated at a distance from the work (Fig. 7). This loader picks

up a tray of pieces, inserts them in the furnace, and withdraws itself by remote control. The same loader removes the treated sections and transfers them to a nearby quench by the same method.

Inspection has been speeded by mounting all plug and ring gages on a single panel (Fig. 8). Whatever the ring section under inspection, the inspector has conveniently at hand the gages required for any piece that passes his station. The Chief Inspector at American Central is proud of the less than 1 per cent spoilage now experienced on the collector ring job.

The final inspection plates on which the completed ring is mounted are a duplicate of the engine mount on the finished plane. Three of these plates were built by American Central. Two were retained at the plant and the third was sent to the customer for comparative checking after shipment. They permit the entire collector ring to be assembled in the same position it will occupy on the plane engine, and all tubular joints and flat surfaces are readily checked on the fitting.

High Performance Fighters

(Continued from page 23)

unavoidable increase in weight, e. g. for armament, armor-protection, etc., must be accompanied by a corresponding increase in the wing area, compensating the increased weight by maintaining the original wing loading.

In designing a high-duty fighter, the "optimum wing loading" should be selected with regard to the theoretically optimum, without at first allowing for take-off and landing requirements, with the help of the known relationship between impact pressure, aspect ratio, and profile drag; which already indicates that for identical top speed the optimum wing loading varies with the air density, i. e., if the ceiling is increased from 9850 ft to 39,370 ft, the optimum wing loading falls to about one-third of the original value. Taking two arbitrary altitudes of 19,685 ft and 39,370 ft as the "rated height" of two separate power units, constituting the full-power "rated ceiling" of two separate fighter designs, points of maximum horizontal speed and rate of climb are obtained, which have been plotted in Figs. 1 and 2 as curves, against increasing wing loading. The loading figures are the optimum values for the respective

altitudes. It will be noted that if the aspect ratio is increased for the high-altitude fighter (dotted curve) from a value of 6 to 9, the optimum wing loading even results in a slightly increased top speed—but this typical high-altitude fighter then becomes unsuitable for operation at low altitudes.

In climbing flight (see Fig 2), conditions are complicated by the fact that any fluctuation of the flying weight materially affects the rate of climb, while any change in the aspect ratio and wing loading inevitably affects the flying weight. From Fig. 2 it is clear that the points of optimum rate of climb (crosses) correspond to much lower wing loading values—about half the wing loading calculated for maximum horizontal speed (circles). The divergence from the dotted curve, falling with increasing wing loading which has been plotted in the usual manner, disregarding the related variations in wing-unit weight, propeller efficiency, and C_L value, is clearly marked. Introducing these variables suitably into the calculation, the optimum rate of climb for the particular aircraft can be determined. An inspection of Figs. 1 and 2 will show the

possible gain or loss of speed or climb in these different designs, requiring compensation in the ultimate compromise solution. Thus, at 19,685 ft altitude, the loss of speed of a "quick-climbing" aircraft is 16.8 mph, but at 39,370 ft it is already 33.6 mph. In the "high-speed" design, on the other hand, the loss of climb is only 3.3 fps in the first instance, and 12.1 fps in the second.

Thus, one power unit developing full output at some given height (rated height) may suitably be combined with two different airframe designs, for highest horizontal speed and best rate of climb respectively; giving two separate fighters which can each be termed a "high-performance" type from one particular aspect, although from the tactical aspect neither can be considered as the optimum solution for the particular engine, since the conditions of combat to be encountered are unpredictable. If in the near future the further development of supercharger design makes engines of still better altitude performance available—for the time being probably accompanied by a certain loss of power at low altitudes, since reaction nozzles will be absent in the direct cylinder exhaust, and drag will be increased by the addition of the indispensable charging air intercooler—the difference between the optimum designs for maximum horizontal speed at low altitude and for maximum rate of climb and ceiling becomes considerable, although only if measured against the horizontal speed near the ground, since the reduction of wing loading essential for high-altitude aircraft has a retarding effect. In aircraft designed for high-altitude flight, the difference between optimum rate of climb and optimum horizontal speed is no longer great—as will also be seen from inspection of Figs. 1 and 2, since intercoolers, etc., are indispensable for high speed at high altitude.

Since the present standard of fighter performance is the practically-attainable ceiling, it will be necessary to examine the relationship between this variable factor and the wing loading (Fig. 3). The ceiling decreases with increasing wing loading, almost after a straight-line law, allowing for the further influencing factors already mentioned; which clearly demonstrates the superiority of the "quick climbing" over the "high-speed" design. A fighter designed for full power at 19,685 ft altitude can gain some 3280 ft of ceiling at the price of the difference in speed of 16.8 mph already mentioned, while a high-altitude design for 39,370 ft can gain a further 5580 ft of ceiling on this already high altitude, at a loss of speed of only 33.6 mph, disregarding for the time being the influence of the Mach number. In compromise designs for the optimum high-altitude fighter it will therefore be preferable to direct the aerodynamical refinement of the wing unit to improving the climbing capacity. The consequent decrease in



how to Fit the Tool Steel to the Job...

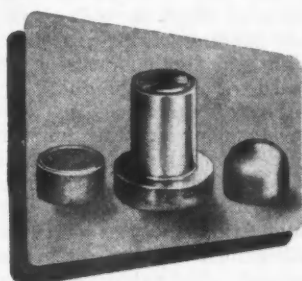
Longer tool life — more output per week from every tool — depends a lot upon selecting the proper tool steel for each job.

And that is where Carpenter can help you — by offering a tried-and-proved method of finding the one tool steel that will do each job best.

In thousands of plants, the Carpenter Matched Set Method of selecting tool steel is providing longer tool life. It is saving many hours that might otherwise be spent for re-grinding, repairing or replacing tools that

fail prematurely. It is giving tool steel users an easier method of selecting the proper tool steel *at the start of each job*. For help in using the Matched Set Method to solve your tool steel problems, ask for the Manual shown below.

And for on-the-spot service, take advantage of the experience of your nearby Carpenter representative. He can show you how to put this useful method to work, improve heat treating procedure and boost output per tool. Put his experience to work on your problems today.



How One Tool Steel User Solved A Tool Failure Problem ...

THE TOOL: A coining punch for forming bearing races from 1015 steel. Production speed—16,000 pieces per day.

THE PROBLEM: Again and again, tools would fail after running only a half-day.

THE SOLUTION: Needing *greater toughness*, they selected Solar tool steel and got these results:

1. Tool life increased from 8,000 to 200,000 pieces, and the tool room had 48 fewer tools to make each month.
2. Output was stepped up 11,160 pieces per month.

THE CARPENTER STEEL COMPANY, 103 W. BERN ST., READING, PA.

Put the Carpenter ...

MATCHED TOOL STEEL MANUAL

... to work in your plant!



Ask for this handy Manual. It contains an alphabetical *Tool Index* and *Steel Selector* and *simplified* heat treating instructions. You can quickly spot the proper tool steel for any one of more than 200 types of tools. This Manual is offered free to tool steel users in the U.S.A. who request it on their company letterheads.



**Carpenter
MATCHED
TOOL STEELS**

the wing loading is dictated also by considerations of lowest take-off and landing speeds and taxi-ing distances.

Since, with the assumptions made, these fighter designs are of pronounced high-speed type, it is opportune to refer to the essential connection between aircraft speed and Mach number at high altitudes. Owing to the relationship between velocity of sound and absolute temperature, the critical value of the Mach number, at which the velocity of sound is attained at some point in the flow, falls appreciably with increasing altitude. For 39,370 ft altitude, the corresponding velocity is 9678 fps, but in high-speed aircraft

further factors intervene at high altitudes to cause the disturbing influence of the critical Mach number to appear earlier. Even at the comparatively high speeds in question, flight at such high altitudes requires relatively high C_L values (up to about 0.5). With such high incidence of the wing, and correspondingly intensive circulation and excess velocity on the forward profile curvature of the upper wing surface, the local effect of the critical Mach number becomes apparent at 39,370 ft altitude already below 500 mph speed of flight. Owing to this effect of the Mach number, the above-mentioned difference of 33.6 mph be-

tween the "quick-climb" and "high-speed" types is not fully developed. The higher C_L value and wing loading at high altitude will cause the critical value of the Mach number, and the accompanying increased drag, to become effective earlier, at the same speed of flight, and thus prevent the aircraft with higher wing loading from developing the calculated maximum speed.

This development of the influence of the Mach number occurs also identically in the case of the propeller blades, where the influence of the Mach number is even more marked, since the tip speed of the propeller blades is so much higher than the forward speed of wing and control surfaces. The propeller efficiencies of modern high-speed fighters in full-power flight at high altitudes are already much below the optimum values standardized during recent years.

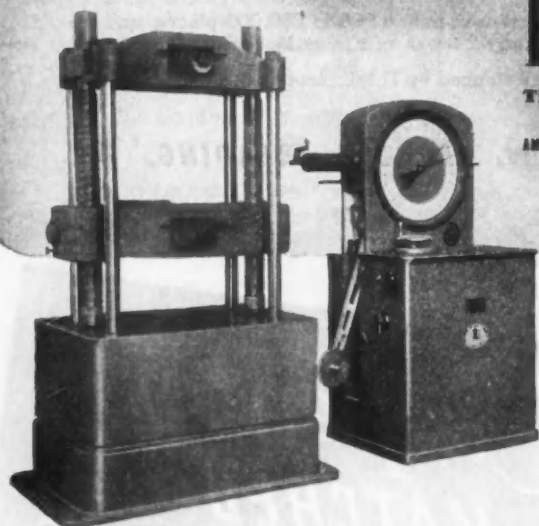
In addition to the demands made by the high-duty fighter on speed and climbing performance, requiring careful balancing, special consideration is required to the development of optimum flying qualities. The high-performance aircraft, developed as a general utility type, is required to behave safely in all conditions of flight, to have sufficient stability at any value of the impact pressure, and to have controls capable of easy operation in all calculated loading conditions. If it is already a problem to balance the forces on the control surfaces sufficiently to ensure easy operation in horizontal and climbing flight as well as in taking-off and landing, at present-day speeds of flight, the further increase in maximum speed will cause the difficulty to be still greater, and not only on account of the development of the impact pressure values. With the occurrence of compression shocks, i. e., the attainment of the critical Mach number at the point in question, the possible reversal of the lift ratio threatens disturbance of the normal relationship between forces and moments on the control surfaces to the extent of seriously affecting the maneuverability and stability. While at present this limit has been reached by fighter aircraft only in diving flight, this is a condition of flight requiring perfect controllability, including the ability to pull out of the dive, and the problem therefore becomes one of particular importance. Although existing fast fighter types appear to behave quite well in diving flight, the lack of explanation of the causes of sundry flying accidents, and of certain cases of fracture where it was by no means certain that the permissible load factor had been exceeded—this will have happened with the same types of aircraft in all countries—would appear to indicate that such disturbances may occur quite suddenly, and then, of course, be very dangerous. It may thus be safely predicted that the development of the high-duty fighter will contribute to the testing and investigation of flying properties at high speeds.

PRECISION HYDRAULIC TESTING MACHINE with Pendulum Load Indication

**MORE ACCURATE, MORE DEPENDABLE
FOR PRODUCTION TESTING because:**

Pendulum load indicator operates on the natural laws of gravitation.

... This principle of operation is not affected by temperature changes or subject to metal fatigue.... Write for descriptive literature and quotations.



RIEHLE

TESTING MACHINES

Division of
AMERICAN MACHINE AND METALS, INC.
East Molino, Illinois

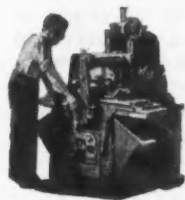


Other Products: IMPACT TESTERS • VICKERS HARDNESS MACHINES • BRINELL HARDNESS TESTERS • MEASURING INSTRUMENTS

Dream Products?

...WE'RE ALL FOR THEM

But



STRATO-LINERS, tear-drop cars, super-streamlined passenger trains, pre-fab houses, electronic gadgets in every home, helicopters and many other "dream products" have been heralded as the stepping stones to new prosperity after the war.

Without minimizing their importance, we feel these things to be still pretty much in the "dream" stage. There's no question in our minds that they will contribute substantially to our world of tomorrow — many of America's great industries, providing work and wages for millions, had their origins in the ideas, experiments and vision of creative, imaginative men — but such things take time to develop.

The gap between wartime production and peacetime manufacturing will most likely be shortened by the making of prosaic things — things we already have and use which war either suspended or curtailed.

One doesn't have to be a crystal-ball gazer to realize that the peacetime future isn't so unpredictable after all. Those manufacturers who are pointing their postwar planning to the production of quality products — in quantity — at low cost — can be quite sure of being among those "most likely to succeed" in the peacetime to come.

To accomplish that objective, machine tools — the most modern and advanced types — are indispensable.

For only with the most modern machine tool equipment can manufacturers hope to attain or excel national industrial par — the vitally significant situation which all must face as summarized in the panel "Spotlight Facts for Your Future I. P. Planning." And only as industrial par is maintained or excelled by industry as a whole can a high level of national prosperity — its benefits in terms of jobs and wages for the greatest number of workers — be achieved.

Let's all back the attack! **BUY MORE BONDS**



What will your
†† future I.P. be?

This is the Fourth of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.

Spotlight facts for your future I.P. planning

- * Production methods — developed in wartime — increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
- * The rate of $2\frac{1}{2}\%$ increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
- * Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
- * Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.
- * The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† Industrial Par — the constantly increasing output per man-hour equal to approximately 50% every 10 years.

KEARNEY & TRECKER
CORPORATION

MILWAUKEE 14

WISCONSIN

Milwaukee Machine Tools

Military Truck Performance

(Continued from page 35)

"accordioning." During the portion of "accordioning" when the vehicle is trying to regain its position in the convoy, the high top speed means greater flexibility in convoy operation.

Rapid deceleration and ability to hold the vehicle in any desired position are requisites for Army trucks. The brakes on all trucks are required to be able to bring the loaded vehicle from a speed of 20 mph to a complete stop within a distance of 25 ft. The brak-

ing system must also be capable of holding the loaded vehicle on a 65 per cent grade.

Many trucks are now equipped with open cabs. These were primarily adopted to permit anti-aircraft defense or rapid egress in case of attack by strafing planes. In addition to the driver protection advantage, the open cab provides improved ventilation during warm weather, better vision while maneuvering the vehicle, and reduced

cubage for overseas shipment.

The bodies used on cargo trucks are actually combination cargo and personnel carrier bodies. Troop seats are provided along the sides of the body. When the vehicles are used for carrying cargo alone the seat portion folds up into a vertical position and, together with the seat back, forms a rack side.

Complete electrical suppression is installed on all tactical trucks. This suppression eliminates all electrical interference generated by the vehicle's electrical system. Thus, although all vehicles do not carry radios, those which are equipped with radios will not have interference set up when another truck passes.

World War II, with its battlefields flung over the entire earth's surface, has introduced special operating requirements for military trucks. The Army has met these requirements by adopting the policy of providing basic vehicles for average operation and kits for installation on these vehicles for each type of special operation. One such special operating condition was that encountered in the African campaign. The problems in this theatre were high temperatures during the day, low temperatures at night, and the requirement for a portion of the vehicles to be able to operate over sand. The high operating temperature requirement was met by the use of a radiator of greater core depth. A radiator and hood cover was developed to permit the cooling system components to retain the high daytime heat over a longer period of time during the cold nights. In order to permit travel over sand, the kits for some of the vehicles incorporate tires of large size and of special flexible construction. Dual rear tires are replaced by single tires which, within practical limits, track with the front tires.

Operation in the northern part of America introduced the problem of extremely low temperatures. The requirement was established that trucks must be able to start instantaneously and operate satisfactorily at minus 40 F. Since the engine friction with any usable oil was extremely high and the power available from a battery practically nil at minus 40 F, it is evident that instantaneous starting could be accomplished only by maintaining the engine and battery at much higher temperatures. This is accomplished by use of a small gasoline burning stove which heats the engine coolant and this in turn circulates by thermosyphon action through the engine and a closed vessel beneath the battery. A hood and radiator cover is provided to assist the coolant heater in maintaining a high under-hood temperature. Side curtains and a passenger compartment heater are provided for use with open cabs.

Thus, it can be seen that the tactical military truck must represent the acme of performance and durability and still be so constructed that it can be produced in volume during a war period, with its accompanying material, ma-

BEARING PROTECTION ... FOR LIFE!



BIJUR

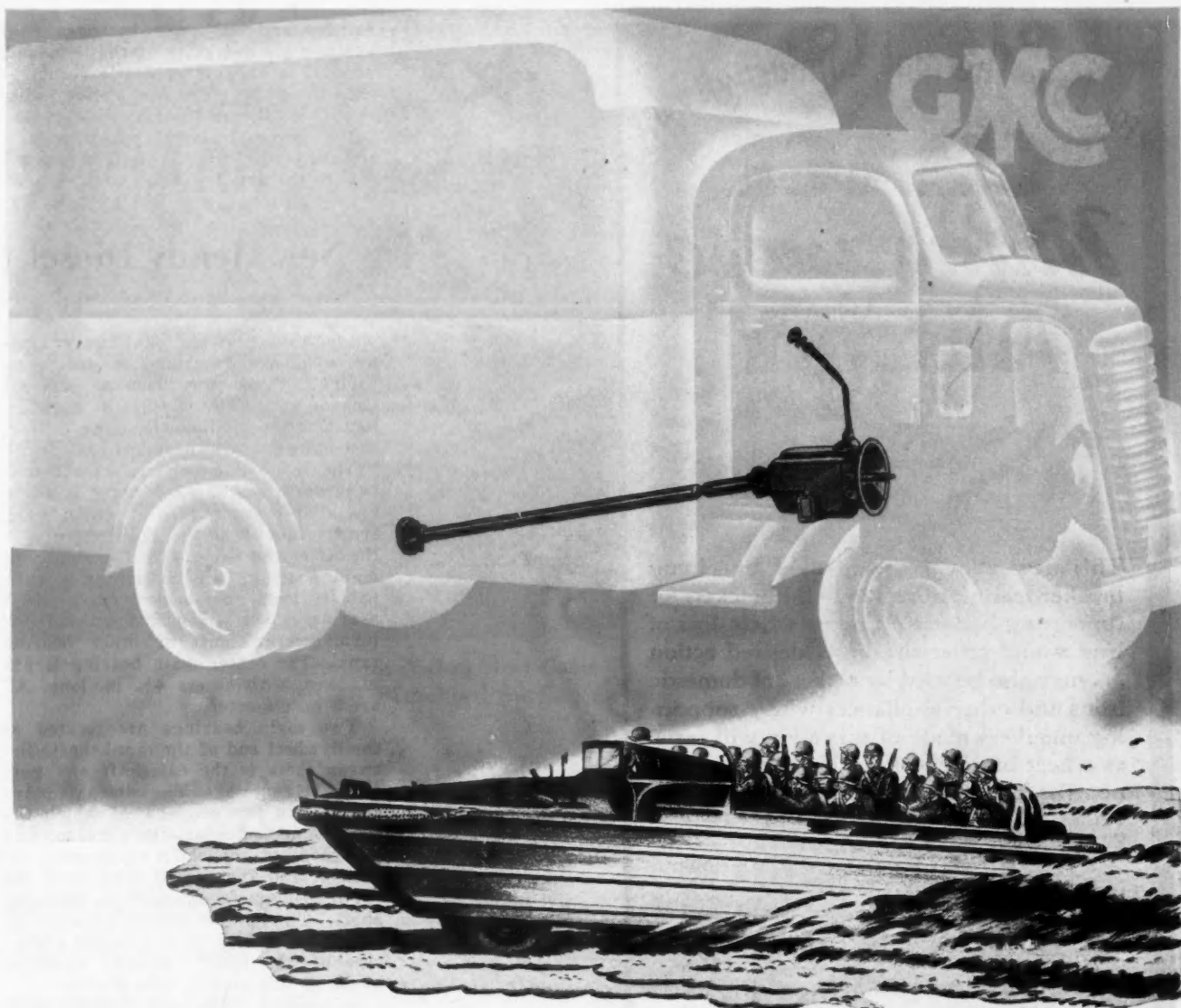
"Gallmeyer & Livingston"
Grinder

The correct
oil film
to each
individual
bearing...
automatically

AUTOMATICALLY *Correct* LUBRICATION

● The Bijur Automatic Lubricating System automatically feeds any number of bearings the metered oil film each requires. Maximum protection for machine life! Bearings, slides, gears . . . lubricated correctly, economically. None forgotten. ● Insure high-speed runs with new-machine accuracy. Avoid expensive production delays. Cut maintenance costs. Protect your investment! . . . With **BIJUR**.

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK



Spicer Universal Joints and Propeller Shafts... for dependable power in Army Ducks or civilian trucks

Newest Army vehicle is the 2½ ton "Duck", propeller-driven for water travel and six-wheel-driven on land. This powerful amphibious truck is driven through Spicer Universal Joints and Propeller Shafts... the same Spicer units that have proved so long-lived and dependable in civilian truck service. Spicer quality permitted quick conversion to the many and varied needs of our Armed Forces, and will permit quick resumption of peacetime production. Spicer Manufacturing Corporation, Toledo, Ohio.



BROWN-LIFE CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES

SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

61

FOR Low Thermal Conductivity USE

CHACE Manganese ALLOY No. 772

This new alloy is being used by circuit breaker manufacturers to build brackets for supporting bimetal elements where loss of heat would otherwise upset desired action . . . may also be used by makers of domestic irons and other appliances where supporting members made of this alloy will serve as a heat barrier to keep handles cool . . . note the following comparative conductivity values:

Silver.....	100%
Copper.....	93%
Aluminum.....	54%
Iron.....	16%
Nickel.....	15%
Monel.....	6%
Chace No. 772 Alloy.....	2%

Chace Manganese Alloy No. 772 also possesses . . . high electrical resistivity properties, about 60% higher than most alloys now in common use . . . high temperature coefficient of expansion, twice that of ordinary steel . . . high vibration damping constant, about 25 times greater than steel . . . it can be machined, stamped, drawn, extruded, and welded to itself or steel . . . now available in sheets, strips, rods and special shapes.

Complete engineering and research facilities available . . . "Bulletin No. A-942" giving detailed information regarding Chace Manganese Alloy No. 772 sent on request.

W.M. CHACE Co.
Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

chinery, and manpower shortages. Such vehicles are operating by the thousands on and in support of battle fronts all over the globe. The automotive industry may take justifiable pride in this major accomplishment which is contributing so vitally to the ultimate defeat of the axis.

New Hendy Diesel

(Continued from page 39)

on both marine and stationary types are fabricated from welded steel tubing. Pyrometer thermocouples are located at the lower sides of each exhaust outlet. Cylinder-head water thermometers are also provided.

The large-diameter crankshaft may be either a solid steel forging or a hollow alloy casting, each of which is designed to exceed the requirements of the American Bureau of Shipping. The main bearings are centrifugally cast, babbitt-lined, steel-backed type. Each bearing is easily removed without disturbing crankshaft or other bearing caps. The center main bearing is 6% in. long, with others 4% in. long. All are 9 in. diameter.

Two main bearings are located at the flywheel end of the crankshaft. Between them is the camshaft and governor driving gear. The camshaft drive chain is in two sections, of which the first connects the driving sprocket and the shaft of the chain-adjustment assembly, and the second goes from the chain-adjustment assembly to the camshaft. The light-weight cast Meehanite pistons have deep ribbing on the underside of the head. Bronze wrist-pin bushings are pressed into pistons.

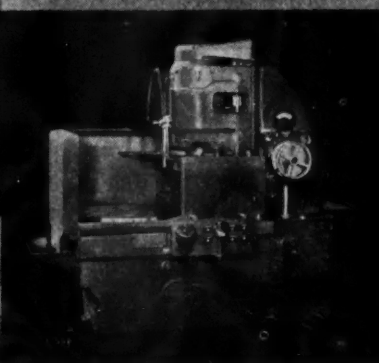
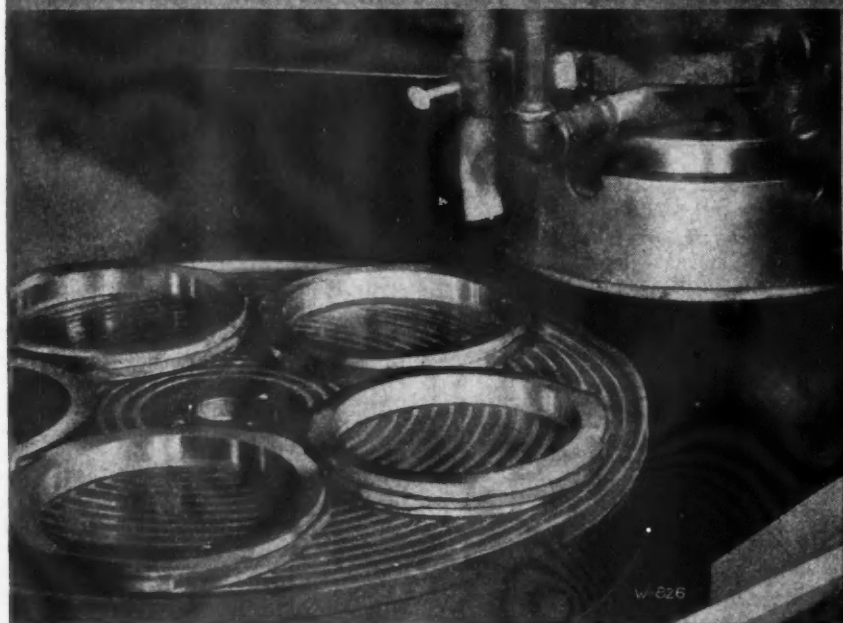
Connecting rods are forged steel, with small ends fitted with removable hard-alloy bronze bushings. Big ends have removable split babbitt-lined bearings. Caps are held to the rods by four alloy steel bolts.

Full pressure lubrication is used with a scavenging pump to remove oil from the crankcase to an external reservoir, and a separate pressure pump to supply oil from this tank through a header to the main bearings and through the drilled crankshaft to rod bearings and pistons. Camshafts, rocker arms, accessories and other parts are supplied by individual lines.

Each cylinder is provided with an air starting valve, to which air is admitted by a corresponding pilot valve driven by the camshaft. Air requirements are cut to a minimum by this method. The cage-type relief valve is so designed that it can also be used as a compression release through manually operated cam action that opens the valve. Provision is also made on each relief valve for attachment of a pressure indicator.

Speed is regulated by a mechanical or hydraulic governor. On marine models, the entire speed range is governor controlled. Starting and operating controls are centralized at the page

"PUT IT ON THE BLANCHARD"



Grinding Nickel Steel Cams on the
No. 18 Blanchard Surface Grinder

These nickel steel Cams are finish ground on the
No. 18 Blanchard Surface Grinder.

.040" to .060" of stock is removed from one
side of these cams to limits of $\pm .001$ ". 109 pieces
are produced per hour.

This is only one of the many airplane engine
parts ground on the Blanchard. Some are held in
fixtures; magnetic, hand-clamping or automatic.

Send your blueprints for production estimates.

The BLANCHARD
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE 39, MASS.



Send for your free copy of "Work Done on
the Blanchard." This book shows over 100
actual jobs where the Blanchard Principle
is earning profits for Blanchard owners.

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ Production
- Adaptability
- Fixture Saving
- Operation Saving
- Material Saving
- Fine Finish
- ★ Flatness
- Close Limits

★ Especially
valuable on jobs like
the one illustrated.

board, where reversing mechanisms for marine engines are also located. The gage board has tachometer, fuel, lubricating-oil and air-pressure gages and pyrometer.

For power take-off, a friction clutch is provided as optional equipment, at opposite end of engine from flywheel. Power up to 20 per cent of the rated horsepower may be taken from this clutch.

In marine installations, both direct and reduction-gear drive models have Timken marine thrust-bearings, force-feed lubricated from engine, and built either as integral parts of the engine or reduction gear. Hendy planetary-

type reduction gears or Farrel-Birmingham continuous-tooth single reduction gears are available as optional

equipment. A flexible coupling is provided between the flywheel and reduction gear in either model.

Forming Vulcanized Fiber Sheets

(Continued from page 40)

was made, and parts were drawn in it, a pressure-pad clearance of approximately 0.005 in. being allowed. Blanks were soaked in water and formed on the draw die on the arbor press. The pressure pad was clamped in position. Several pieces of vulcanized fiber also were soaked in steam. The accompanying photographs show some of the

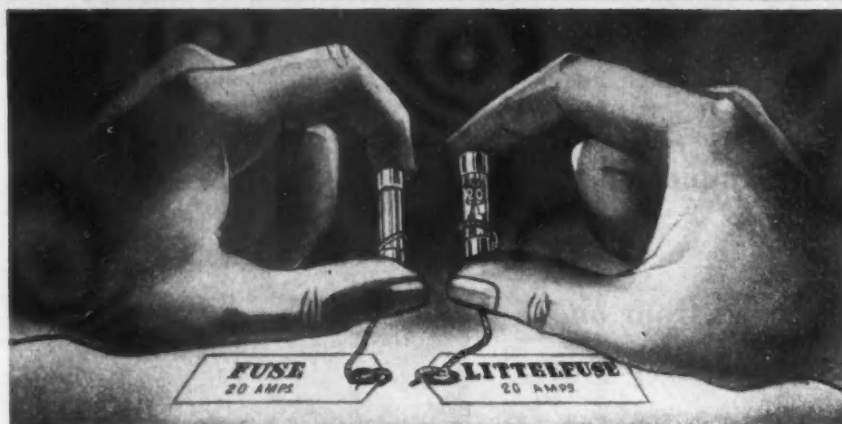
parts formed and the tooling used in the forming processes.

Test Results—The dry fiber cracked very easily when bent. However, when soaked for 15 min it could be folded 180 deg without breakage. Hydrostone blocks were not practical, owing to difficulty experienced in drying the parts. A soaking period of from 5 to 15 min gave best formability (fiber grows in all directions when soaked). Parts were formed successfully on the lead-Kirksite tooling. The heated dies greatly accelerated the drying process, and four parts (pilot's arm rest) were formed in one minute, the tooling being manipulated by hand. Uncoated parts allowed to stand in air for 24 hr warped considerably, while coated parts were not affected. All parts soaked in water warped. However, no warpage was noticeable on the coated parts for the first four hours of immersion.

No successful parts were formed on the box die. This probably was due to the small corner radii and the use of a rubber-actuated pressure pad. The 5 in. cup was drawn to a depth of approximately 2 1/4 in. Due to the design of the die, larger blanks could not be used. However, because of the forming of wrinkles, draws deeper than about 2 1/2 in. would not be practicable. Parts soaked in steam became very pliable after 3 to 5 min. Such parts were more easily dried, as they contained very little surface moisture. From these test results the following rules regarding the forming of vulcanized fiber parts may be established:

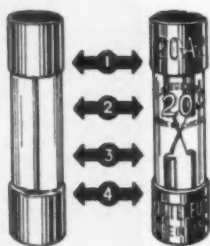
1. Fiber must be water or steam-soaked from 5 to 15 min before forming, depending on the severity of the operation and the gage of the material.
2. Parts must be held in shape until dry.
3. Parts must be coated after drying to prevent subsequent warpage due to moisture absorption.
4. Tooling should be such as to hold parts in shape until dry; heated tools accelerate this process. Wood drying blocks also may be used.
5. Draw dies must have positive pressure pad-draw ring clearance, and punch and draw radius equal to a minimum of 12 T.
6. Fiber may be bent to a 1T radius after soaking.
7. Cups may be drawn to a depth equal to the cup radius after soaking.
8. Corner radii should be held to a minimum of 1 in.
9. Fiber will stretch, but has very little tendency to shrink.
10. Except for bending operations, fiber should not be formed in gages thicker than 0.081 in.

Compare LITTELFUSE with an ORDINARY FUSE



ORDINARY FUSE

- 1 Cap forced, tapped, or cemented on. Easily loosened.
- 2 No reinforcement. Blowing time not precise.
- 3 Mechanically polarized. Responsive to vibration.
- 4 Unprotected against contraction and expansion.



LITTELFUSE

- 1 LOCKED CAP ASSEMBLY (Pat.). No cement.
- 2 Elements twisted at 90° against severe vibration.
- 3 Mechanically depolarized against vibration.
- 4 "Gooseneck" takes up contraction and expansion.



Engineered FOR TODAY'S NEW CIRCUIT PROTECTION!

"Quicker than a short circuit."

Extraordinary factors of strength, security and precision are now imperative in ever-widening fields of new and improved electrical products. All the specialized resources of Littelfuse's two plants, engineering, design and construction are employed to meet and anticipate unprecedented requirements.

Whatever your problem in circuit protection Littelfuse will be glad to help you.

LITTELFUSE Incorporated

200 Ong St., El Monte, California

4757 Ravenswood Ave., Chicago 40, Ill.

ro-
uc-

in

ed
en
ed
ro-
ng
he
to
er
l).
he
es
ss,
re
ng
ts
ed
re
er
as
he

on
ue
of
he
p-
gn
be
m-
an
le.
ry
ts
n-
e.
ng
il:
m-
re
e-
he

til

y-
p-

ld
ed
od

ve
r-
is

us

th
er

a
ry
s,
n

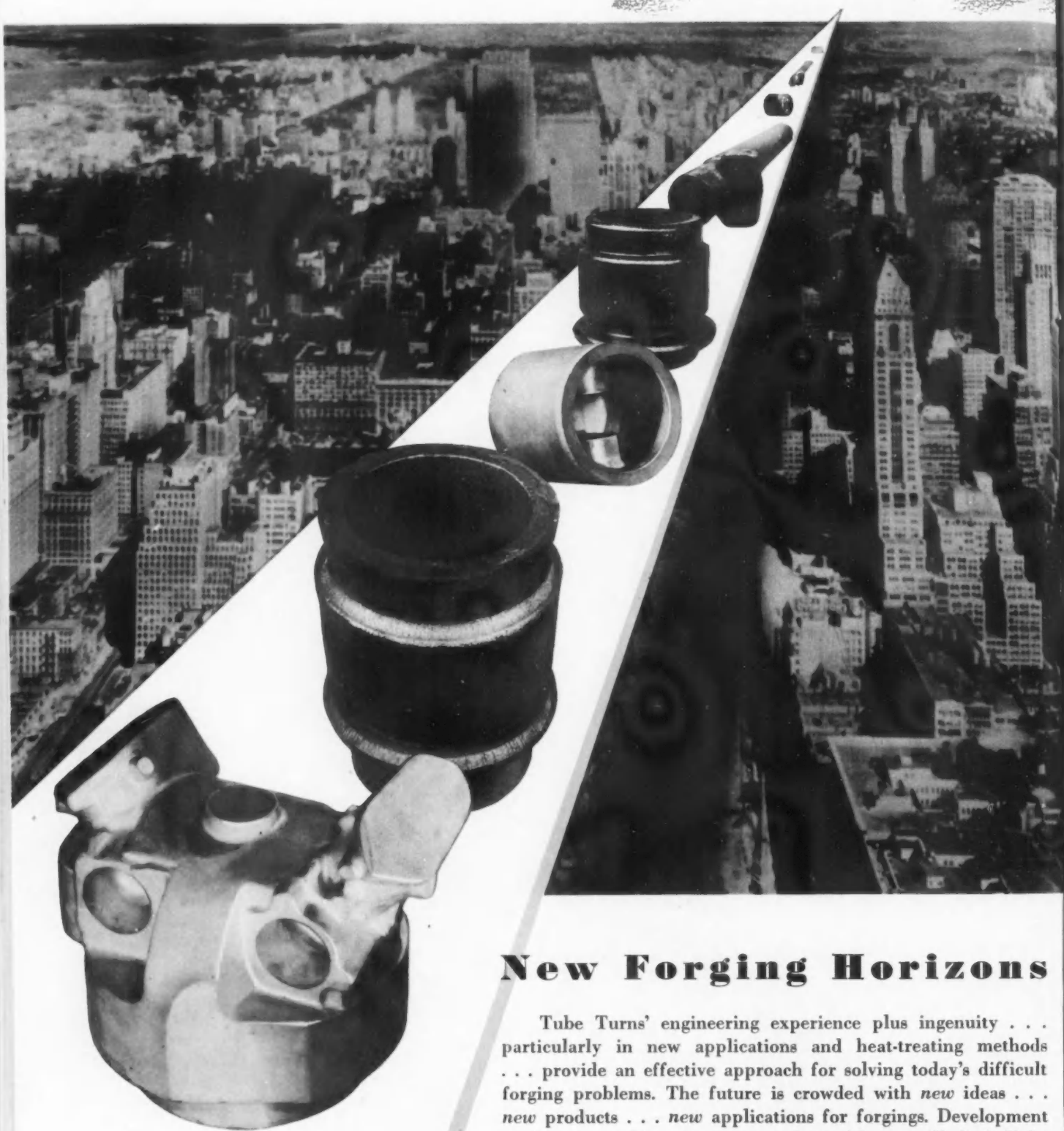
es



Joe Foss Downs Another

BY JAMES M. SESSIONS

NO. 4 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY. SEE OTHER SIDE



New Forging Horizons

Tube Turns' engineering experience plus ingenuity . . . particularly in new applications and heat-treating methods . . . provide an effective approach for solving today's difficult forging problems. The future is crowded with *new ideas* . . . *new products* . . . *new applications* for forgings. Development engineers, working on tomorrow's problems, will find Tube Turns ready and able to cooperate.

TUBE TURNS (Inc.), Louisville, Kentucky.

TUBE TURNS

Forgings for Industry

The dramatic air-action in "Joe Foss Downs Another" portrays (on the reverse side) the flying U. S. Marines . . . the 4th of 12 Sessions war paintings presented by Tube Turns.



Magnesium in Aircraft

(Continued from page 31)

they are inferior to 56S in contact corrosion. For flush riveting gages less than 0.040 in., 120 deg. countersunk rivets have been used on dimpled sheet. Satisfactory tools have been developed for hot dimpling the sheet for this type rivet. Machine countersunk rivets may be used for gages of 0.040 in. and greater. When countersinking the hole a minimum thickness of 0.015 in. should be left at the base of the countersink. Any standard head angle may be used for countersunk rivets. The recommended edge distance is $2\frac{1}{2}$ times the diameter, with a minimum of twice the diameter. A minimum spacing of 4 times the diameter is generally recommended.

Arc Welding Practice

Due to the great pressures exerted during arc welding, jigs must be very rigid and the parts firmly secured. In regard to the use of jigs during the stress-relieving operation, these have not been found necessary except in an assembly which does not have the ends tied together structurally. Assemblies which are held in shape by formers or bulkheads have caused no trouble. Large surfaces with but a slight curvature may have a tendency to buckle inward as the stress is relieved. To prevent this it is not necessary to stress-relieve in the entire welding jig, as light formers can be temporarily secured in place during stress-relieving as required.

For stress-relieving assemblies which are combined riveted and arc welded structures, and where the relieving temperature would burn out the primer at the faying surfaces the following practice is recommended:

- Chemically treat (Dow #1, 7, or 10) the component parts.
- Remove chemical treatment at weld edge surfaces with steel wool and, by shearing or grinding, obtain a freshly cut edge. Usual cleaning methods, such as wire brushing, will not penetrate a sheared edge that has been pickled.
- Assemble riveted parts, using almalastic paste or Fuller's chromate compound to protect faying surfaces. These preparations will withstand the stress-relieving temperature.
- Make arc welds.
- Stress-relieve at 400 F. for one hour.
- Chrome pickle the areas that have been cleaned for welding by the "brush-on" method.
- Prime and paint the entire assembly according to recommended schedule.

The stress-relieving temperature does not affect the corrosion or strength properties of 56S rivets, but does affect some of the other aluminum alloys.

Inspection of Arc Welded Joints

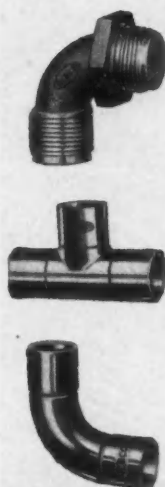
Considerable cross-checking has been done between X-ray and visual inspection and it has been found that in prac-

tically all cases shrinkage cracks discovered by the X-ray were also discernible by visual inspection if the joint was chrome pickled prior to inspection and if a sufficiently powerful glass was used. It appears, therefore, that shrinkage cracks will always appear on the surface. The work now being done on the use of Zyglon for the inspection of arc-welds looks very promising to date. Internal porosity can only be determined by X-ray. Experience has shown, however, that if

the surfaces and edges are properly and adequately cleaned, any porosity in a weld that passes visual inspection will be so minor that the strength of the weld is not reduced.

Service Experience

Castings, forgings, and extrusions have been practically 100 per cent satisfactory. There are several million pounds per month of sand castings being used in engines, wheels, and airframes, and we rarely hear of any service troubles from these. Although not used extensively, forgings and extru-



NIBCO WROT AND CAST ALUMINUM FITTINGS HELP
Get 'em Flying QUICKER!

YES, NIBCO WROT Fittings are now made from aluminum as well as copper. They are speeding up airplane production because of their absolute uniformity. Every piece is perfectly formed . . . uniform in thickness and strength. They're used in many famous battle planes, including the Boeing Flying Fortress. The same qualities which recommend NIBCO Fittings for that very trying service prove that they will be ideal for your Post-war products. We'll be glad to discuss your plans for future needs at any time.



NORTHERN INDIANA BRASS CO.

ELKHART, INDIANA

VALVES AND FITTINGS SINCE 1904



sions have apparently given equally good service.

The case of sheet is somewhat different; practically all instances where magnesium has not done the job expected have been applications utilizing sheet. Many, of course, have been satisfactory, and sheet is widely used for oil tanks, wheel fairing, instrument panels, turret parts, and miscellaneous cases.

Most of the failures have occurred on so-called non-stressed parts, using thin gages which, in many cases, have been substituted for the stronger aluminum alloy on a gage-for-gage basis. Such parts, while not primarily

stressed, are subjected in many cases to considerable vibration and abuse. Thin magnesium sheet, perhaps due to its lower ductility and greater notch sensitivity, does not seem to stand this service as satisfactorily. Many of these failures have occurred at points of attachment, and in some cases the trouble was overcome by proper edge reinforcement and the use of doublers. It is apparently the current practice, on aluminum, to reinforce large, flat panels with stiffeners which do not necessarily tie into the main frame. Doors and panels constructed of magnesium sheet in this manner have not worked out and failure has occurred

by cracking at the ends of the stiffeners where the vibration is concentrated. Similarly, hinges or fittings which have been attached to sheet and not reinforced at such points by doublers have often failed by cracking. Flooring is another example where conventional aluminum design has not always been satisfactory for thin magnesium sheet. Here the local overloading and impact have sometimes caused premature failure. Observation has indicated a satisfactory service experience in both British and German machines for such parts as fairing, cowlings, doors, seats, control surfaces, and fuel tanks. In all cases sheet corresponding to Dowmetal M was used, although the minimum gages were somewhat greater than usual American practice. Very few cases were observed where sheet thinner than 0.040 in. was used.

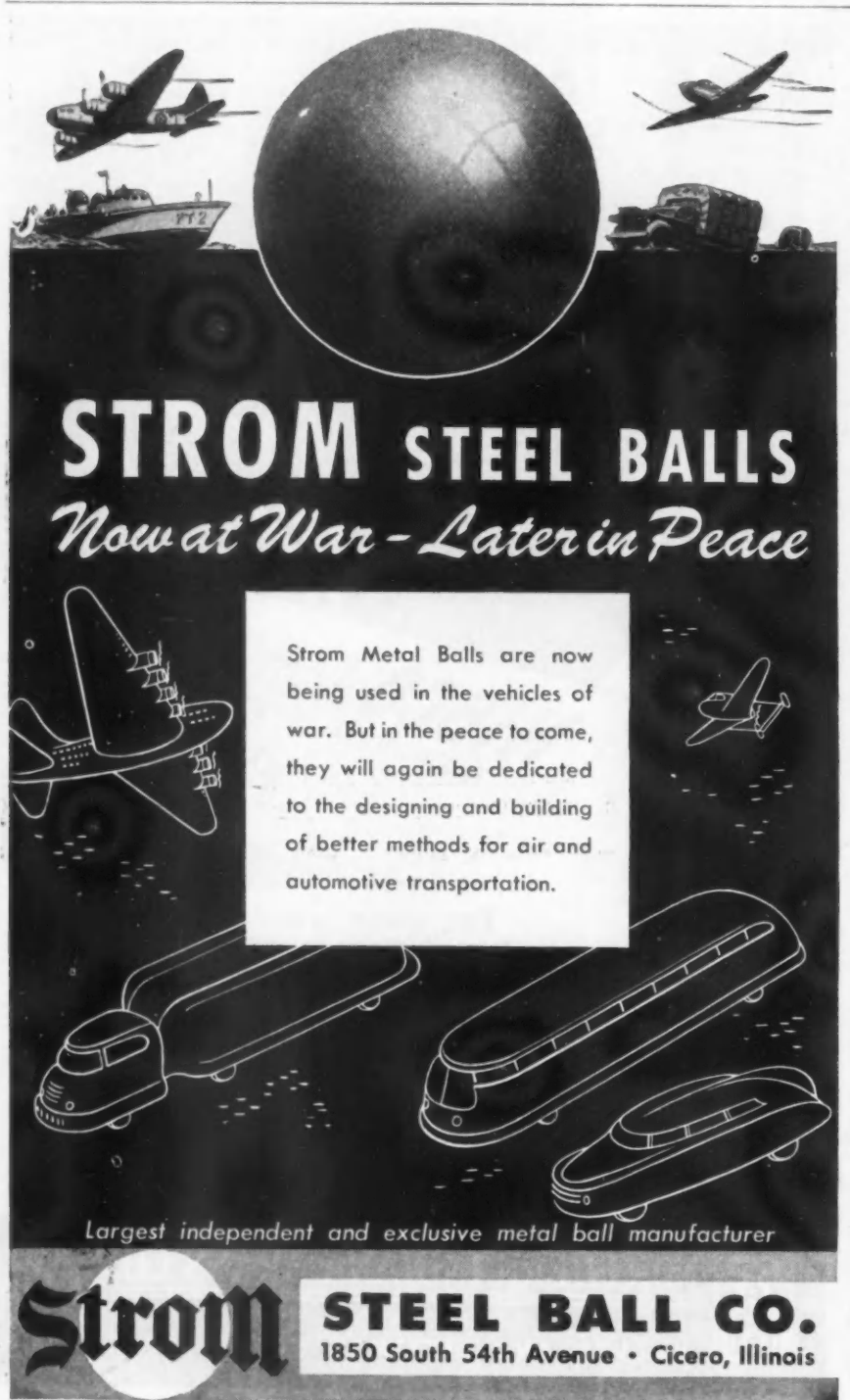
Considerable work has been done to determine the effect of gunfire on magnesium. This has included firing tests on complete structures, such as wings, as well as on small panels. The conclusions reached are as follows:

Magnesium is not ignited by incendiary bullets. Solid shot does not affect magnesium structures much differently than it does aluminum. The shot removes the metal in its path but does not propagate cracks or tears excessively. There is much less tuliping than with aluminum and the holes are less ragged.

Explosive shells are more destructive to magnesium structures than to aluminum structures. Our observation has been that solid shots into a large liquid container, such as a gasoline tank, produce an effect similar to an explosive shell and cause more damage to the magnesium surrounding it than to aluminum. Perhaps paradoxically, the British have had a very satisfactory use of magnesium as gas tanks in their Spitfire airplane.

Primary Structures

Several structures have been designed, built and satisfactorily tested both statically and in vibration. In all cases a substantial weight saving was accomplished, particularly in control surfaces where appreciable saving is made in balance weight. Only a few of these structures have reached the flying stage but these have been satisfactory so far. The British are using magnesium sheet as covering for control surfaces and over portions of the wing on some planes, and have one model, of which about 100 were built in 1939, having the rear fuselage of monocoque magnesium design.



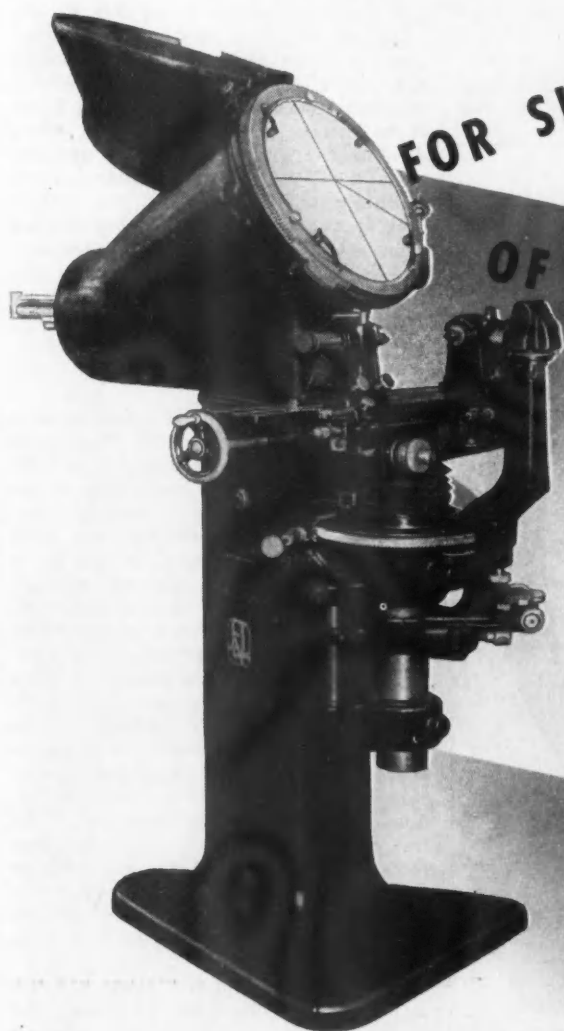
STROM STEEL BALLS
Now at War - Later in Peace

Strom Metal Balls are now being used in the vehicles of war. But in the peace to come, they will again be dedicated to the designing and building of better methods for air and automotive transportation.

Largest independent and exclusive metal ball manufacturer

Strom STEEL BALL CO.
1850 South 54th Avenue • Cicero, Illinois

Save and Win
with War Bonds



FOR SIMPLIFIED INSPECTION

OF COMPLICATED PARTS...



You are making parts for airplanes, engines, shells, fuses, bombs, guns or tanks . . . Parts that are slow, difficult or even impossible to inspect by mechanical gaging . . . You'll be interested in these facts about **Jones & Lamson Optical Comparators** in the tool room or production line—

- They permit rapid, accurate inspection and comparison by means of a magnified shadow.
- They permit the measurement of angles in degrees and minutes. Lead or spacing. Height or depth.
- They permit the inspection of tools, gages and parts with irregular contours, by comparison with master outlines.

Jones & Lamson Inspection Engineers can help you set up the fastest, most economical method of staging and handling your inspection work. Their knowledge of holding fixtures, handling methods and suitable Comparator equipment is saving many thousands of dollars in manufacturing plants throughout the country.

We invite you to send samples or blue prints to Jones & Lamson Machine Company, Springfield, Vermont.

For rapid, economical inspection . . .

BEYOND A SHADOW OF A DOUBT!

JONES & LAMSON
MACHINE COMPANY
OPTICAL COMPARATORS

Springfield,
Vermont, U.S.A.



PROFIT-PRODUCING
MACHINE TOOLS

Manufacturers of:
Universal Turret Lathes •
Fay Automatic Lathes •
Automatic Thread Grinders •
Optical Comparators •
Automatic Opening Threading Dies

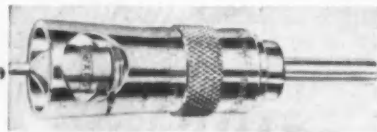
April 1, 1944

When writing to advertisers please mention **AUTOMOTIVE and AVIATION INDUSTRIES**

69

New Products for Aircraft

(Continued from page 44)



Micro-set stop countersink

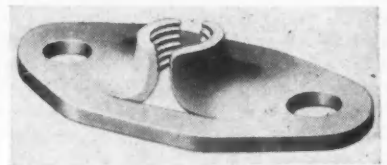
shaft and is vibration proof, and permanent lubrication reservoir.

A spring loaded spindle retracts cutter back into stop cage for safety to operator and materials, thus protecting

cutting edge of tool and increasing the life of the cutters. Its bell shape design eliminates any tendency to rock and minimizes the danger of scratching working surfaces. Concentricity of the shaft, pilot and cutter limits are held to .002 in. indicated reading and all parts are interchangeable.

"Hi-Stress" Speed Nut

A new "Hi-Stress" Speed Nut, conforming to AAF specification No.



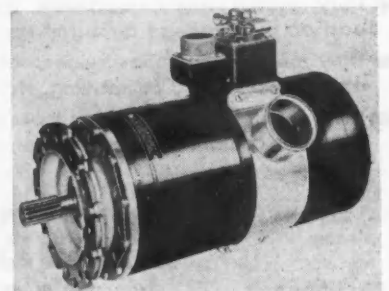
Tinnerman "Hi-Stress" Speed Nut

25531, has just been developed by Tinnerman Products, Inc., Cleveland, Ohio, and approved by the Army Air Forces. This new nut is a lighter weight, one-piece integral unit with an unusually low installation torque that allows speedier insertion of screws and bolts. It is interchangeable with nut plate AN362, for high temperature applications in all structures. Another feature of this new "Hi-Stress" Speed Nut is that it retains its self-locking torque even after many removals under service conditions. It is identified by No. A6103H-1032.

AC-DC Power Supply Systems

The Eclipse Pioneer Division of Bendix Aviation Corporation, Teterboro, N. J., is introducing Eclipse AC-DC power supply systems consisting of engine driven AC-DC generators and carbon pile voltage regulators, for both the a-c and d-c outputs, to provide a dependable source of alternating current for operation of various radio devices and direct current for operation of d-c electrical equipment. The generators are designed to mount on main engine generator drive pads of aircraft, now in production or undergoing design, incorporating provisions for generator blast cooling. They incorporate 6 in. round flanges with 12-25/64 in. holes, 5 in. bolt circle diameter, 4.122 in. pilot diameter, a 16 tooth involute male drive spline and arc available in various capacities ranging from 60 to 200 amperes at 28.5 volts direct current and 10.4 to 30.5 amperes at 115 volts alternating current.

Both the a-c and d-c rated outputs are available simultaneously over the entire rated speed range offering weight-saving advantages over systems utilizing separate d-c and a-c power supply equipment. On twin or multi-engine installations a mixed system incorporating separate engine driven AC-DC and d-c generators offers the same



Eclipse Type 1097 Engine Driven AC-DC generator



*What's SURE
About Tomorrow's Models?*

Amid schemes and dreams for tomorrow's cars, stands one certainty... out of war developments motors will achieve a new high in operating efficiency.

Wherever control of temperature promotes that efficiency, there is a spot for a Dole Thermostat. Their record in closely controlling motor temperatures for long periods recommends their use on any new model.

THERMOSTATS
by
the **DOLE** valve company
1901-1941 Carroll Avenue
Chicago 12, Illinois
LOS ANGELES • DETROIT • PHILADELPHIA

*Machine tools help to make him the
Hope of the world!*



MMeet "Flash" Jonesey, champ of the soap box derby. He built that job with his own two hands and his old man's basement tools. . . . He's the great American dream, and the hope of this cockeyed world.

For it's because America raises kids like Jonesey that America is winning this war. Kids who were weaned on mechanical toys, and cut their eyeteeth on tools. Kids who grew up to be the finest fliers and fighters, engineers and builders the world has ever seen. . . . And it's because of millions of kids like Jonesey that America will have a priceless legacy of the world's finest skills, after this war is won.

The responsibility to use those skills wisely and well is one

of the greatest industrial challenges ever to face this nation.

If you are a manufacturer, there is one thing that you can do at once: Have your production men and planners consult now with the engineers of the basic machine tool producers. They can help you in planning ahead the difficult task of reconvert- ing your own skills and machinery to an all-out peacetime production.

One of these engineers is a Bryant man — and his special- ized knowledge of internal grinding machinery is important to the manufacture of literally everything that will mean jobs and prosperity after the war . . . that will make America's priceless legacy a new hope for the world.



BRYANT CHUCKING GRINDER COMPANY

SPRINGFIELD
VERMONT, U. S. A.

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

71

weight-saving advantages and increased power.

Tubular armature shaft and air blast cooling contribute to maintenance of safe operating temperatures, and increased strength is provided by the steel mounting flange. A floating type flexible torque drive shaft absorbs the torsional vibration and compensates for any slight misalignments between engine and generator drives.

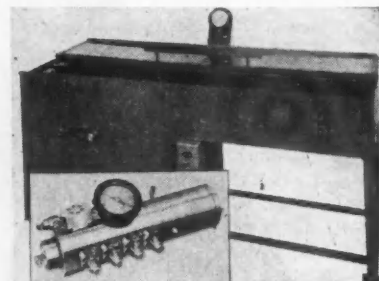
Rotating field inductors in the generator design permits the use of stationary a-c windings, and d-c outputs of more than one AC-DC generator can be paralleled. The carbon pile voltage regulators provide continuous regula-

tion without fluctuation, and with a minimum of radio interference due to the absence of vibrating contacts.

"Hy-Mac" Test Bench for High Pressure Testing

A hydraulic test bench Model T-113, including an intensifier that is capable of developing up to 30,000 psi, has been brought out by Hydraulic Machinery, Inc., Dearborn, Mich. The hydraulic circuit consists of a 2000 psi constant delivery pump (approximate delivery of 2 gallons per minute) which is directly connected to a manifold incorporated in a high pressure intensifier that is

hydraulically operated with a ratio of 15 to 1, producing pressures up to 30,000 psi. Remote control, through a hand adjustment, thus makes available pressures up to 30,000 psi at the manifold. Included in this model of "Hy-



Hydraulic test bench Model T-113. Inset shows a closeup of intensifier

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.



Center Scope Brings Optical Precision to Machine Shop Operations

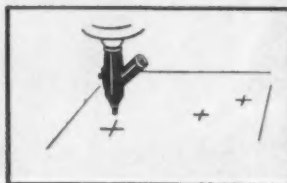
The Center Scope is an optical centering and locating tool that can be easily and quickly used on any machine to center work reference lines to a spindle axis. It permits accuracy to a degree never before obtainable, as the optical beam or line of sight is absolutely inflexible and cannot be distorted.

The Center Scope's easy accuracy eliminates many human errors, as the operator can see just what the cutting tool will do before it is actually fed into the work. It increases production, improves efficiency and prevents spoilage. There is no pressure on the work piece nor is it subject to wear or changes in temperature—for the Center Scope never touches the layout.

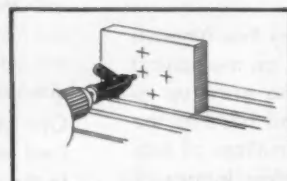
The Center Scope enables the operator to easily and quickly locate edges to a spindle axis, set-up faster and compensate for run-out. It saves vital hours in checking, inspecting and measuring when mechanical methods and tools are impossible to use. Its 45 x magnification allows operator to see ".001" and requires no technical knowledge or training to operate.

While there is nothing particularly new or ingenious about Wrigley's Spearmint gum, it is proving useful to millions of people in many new ways. Workers in war plants everywhere have found it helps keep them alert and relieves nervous tension and dry mouth while they are on the job.

You can get complete information from the Center Scope Instrument Company, 351 S. LaBrea Ave., Los Angeles, Calif., or Kearney & Trecker Products Corporation, Milwaukee, Wis.



ON A VERTICAL MILL—locating and centering height gauge or size block layouts. Permits jig borer accuracy on more machines.

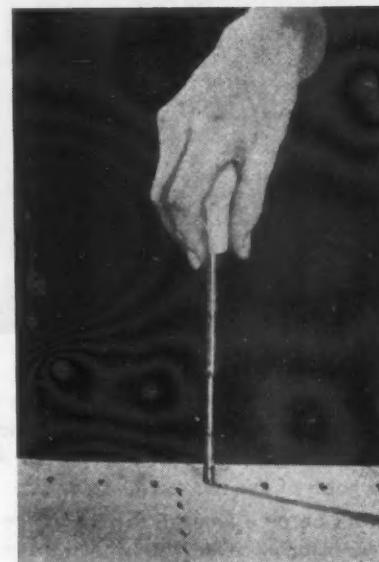


ON A HORIZONTAL MILL—the ability to center a layout, edge block or rotary table plug while spindle is running. Permits quick and easy set-up for high precision work.

Mac" extreme pressure intensifier are: Special high unit pressure connections throughout, special balanced high pressure plunger and packless plunger sealing, special extreme pressure inlet check valve for charging the high pressure cylinder and multiple in-line high pressure connections for burst testing four tubes or other parts simultaneously.

Burring Tool for Aluminum Parts

The Vesco Company, Detroit, Mich., is manufacturing a tool for removing burrs from drilled holes in aluminum parts of airplanes. To operate, the tool is gripped by the handle, the cutter

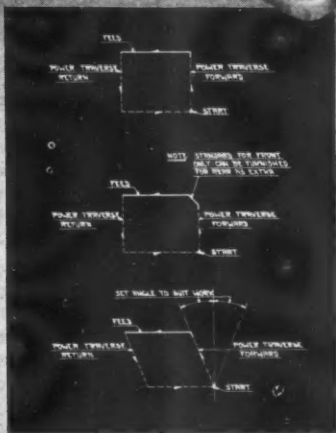
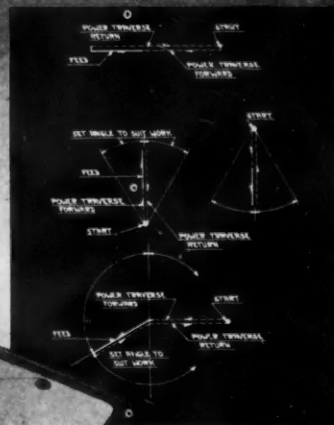
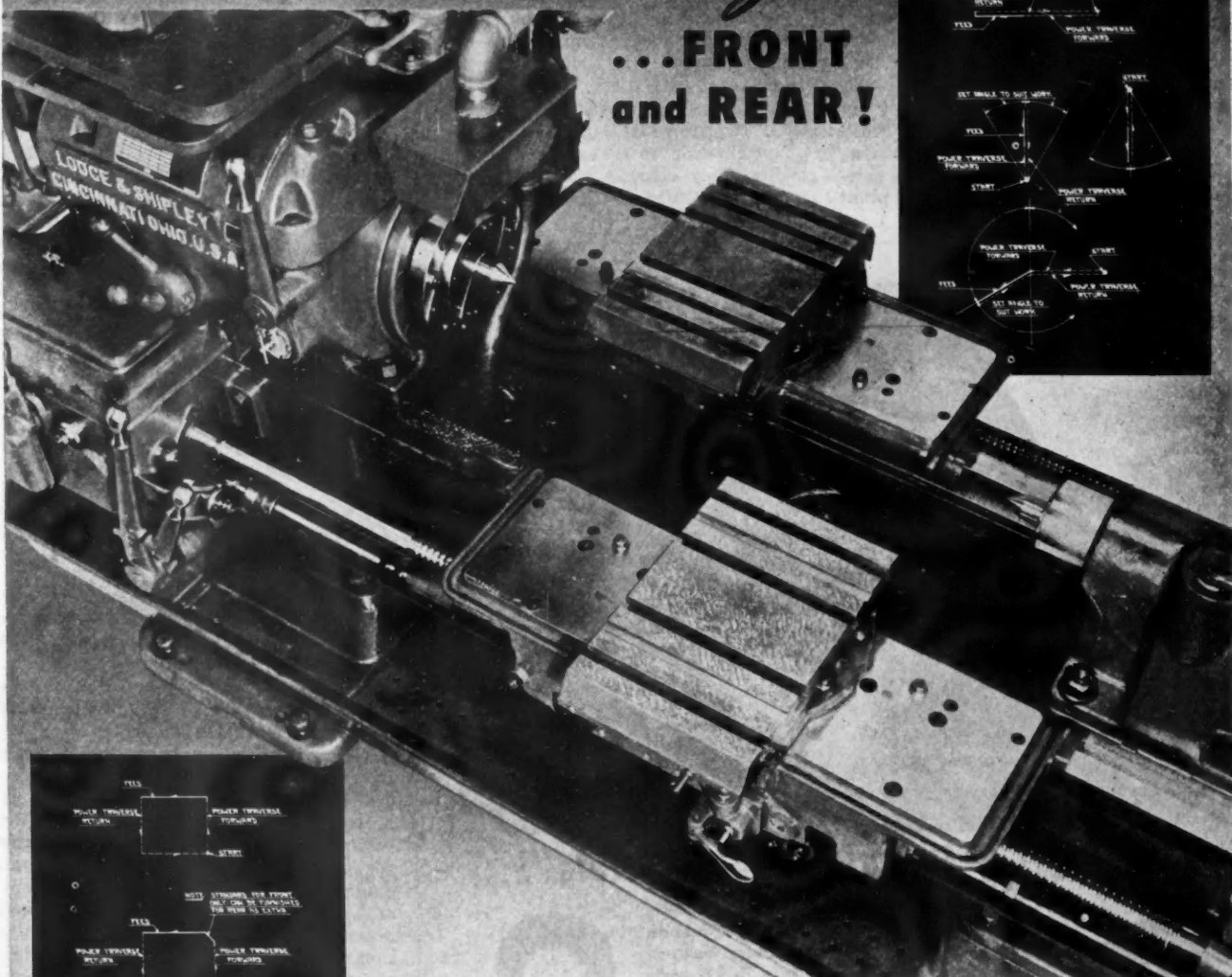


Tool for burring drilled holes in aluminum

inserted in the hole to be burred and pressed down. This removes the burrs in one operation. A spring is incorporated in the body of the tool which provides sufficient pressure against the small countersink to insure removal of the burr from all hole diameters varying from 3/32 to 3/16 in.

Standard Cycles

...FRONT
and REAR!



THE No. 3-A DUOMATIC LATHE is a full automatic lathe for the advantageous use of multiple tools in turning and straight and angular facing operations. It is particularly adapted to quantity production of lathe work in small or large lots whether between centers on an arbor or in suitable chucks or fixtures.

Oct. 8, 1943

Feb. 23, 1943

Aug. 23, 1942

March 6, 1942



Write for Descriptive Booklet, No. 601-FL.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.

ENGINE

TOOL ROOM

AUTOMATIC

OIL COUNTRY LATHES

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

73

Aircraft Engine Output

(Continued from page 46)

sections on a former automobile assembly line, with 30 fixtures holding the wing sections as they progress from station to station. Smaller lines build up subassemblies which are fed into the final line. Former automobile paint ovens and spray booths have been utilized in painting the airframe sections. DeSoto Division assembles the right center wing section, while Chrysler Division handles the left wing section. These sections then are shipped to the Curtiss-Wright Corp. plant

at Port Columbus, Ohio, for integration in the complete plane.

With contract cancellations due to average \$1½ billion per month for the first six months of 1944, according to estimate in the Senate Truman Committee's third annual report, government policy on such cancellations is pertinent. In a recent letter to Sen. Francis Maloney, Connecticut Democrat, Donald M. Nelson enunciated such policy.

"The military services determine their requirements, and when our rate of production is in excess of requirements, they consult with WPB to determine the advisability of cutbacks in

the program," wrote Nelson. "The final decision that a cutback is necessary rests with the military, and they collaborate with WPB in determining where the cutback is to be made."

"As you know, manpower is the most critical determining factor in war production today. So far as possible, we attempt to guide the cutbacks in the critical labor areas, in order to ease the manpower situation in these areas. For instance, in the Connecticut Valley we need manpower badly in the ball bearing plants. As is well known, ball bearings are one of our most critical components. It is not exaggerating to term them our No. 1 production problem. They play an indispensable part in practically every major military program, notably airplanes and trucks, and they are urgently needed for essential civilian programs, such as farm equipment. Consequently, we must try by every means at our disposal, including such cutbacks as may be practicable in other local industries, to solve the problem of more manpower for the ball bearing industry in the Connecticut Valley."



Protecting the Airplane's "Vitals"!

● Safeguarding both men and instruments in modern planes, Western Felt is playing a versatile role in all sorts of mechanisms.

Felt protects men through its use as weatherstripping, pads, thermacoustic cabin lining, insulation.

Flexible, resilient, compressible, resistant to age, water, heat and shock—felt protects delicate instruments through its use as channels, gaskets, pads, washers, cushioning gaskets.

Western engineers are prepared to give you the complete story of felt's place in modern planes, and to suggest new uses for this versatile material in your product. Write us today.

WESTERN FELT WORKS
4035-4117 Ogden Ave., Chicago 23, Ill.
Branch Offices in All Principal Cities

Largest Independent Manufacturers and
Cutters of Wool, Hair and Jute Felts



WESTERN

Felt

Continental Rubber Works

(Continued from page 30)

economical manufacturing which makes possible the maintenance of lowest costs consistent with high quality.

This background sheds considerable light on the service that Continental has rendered in the past and is prepared to give the automotive industry in the postwar era. One of the proudest claims of this organization is its unusual ability to render service to the industry in an emergency or during seasonal model changeovers when changes in design are fluid and delivery of products of new designs of utmost importance to meet the start of production. Continental enjoys the reputation of meeting such emergencies immediately.

A recent news release by Curtiss-Wright on the effectiveness of the SB2C Helldiver in the Pacific pays tribute to a group of companies supplying parts for this marvelous weapon. It comments on the fact that Continental Rubber Works has been making parts for the Helldiver since 1940 and is currently producing molded and extruded parts of exceptional quality.

From the standpoint of productive facilities, the company is proud of a modern plant, fully equipped with the latest types of equipment necessary to produce mechanical rubber goods for automotive purposes. As is usual in this type of industry, some of the equipment is of conventional character, but much of it consists of special machinery designed by the company itself. To offer a high-spotting of activity in the plant, we have selected a group of illustrations with suitable descriptive captions which will enable the reader to visualize the character of the facilities as well as their function.

FITCHBURG GRINDS ACCURATE TO .0000025"

CONTINENTAL MACHINES
Incorporated

1301 WASHINGTON AVENUE SOUTH
MINNEAPOLIS

October 8, 1943



ASK FOR
YOUR COPY



DO
BAND SAWING
BAND LIKE
BAND POLISHING

The National Machine Tool & Supply Co.
Att: Mr. C. O. Hanson
13 No. 1
Minneapolis, Minnesota

Dear Mr. Hanson:

I believe you will be interested in a job which we performed on the Fitchburg Grinder recently purchased from you.

The job consisted of grinding the O.D. of a piece of hollow tubing 1-1/2" in diameter and approximately 4" long. This part is used as a master squaring gage, and the grinding had to be held to extremely close tolerance of accuracy. Several attempts were made to grind the part by conventional holding methods, but it was found that upon releasing the work from the arbor it would distort beyond the limits to which the part had to be held. We finally devised a method of holding the tubing during the grinding operation, and using the Fitchburg Grinder we were able to grind 100 of these parts to an accuracy of 25 millionths maximum taper over the 4" length, and within 25 millionths of concentricity.

Needless to say, we are very well pleased with our Fitchburg Grinder when we can use it to grind down to millionths in accuracy.

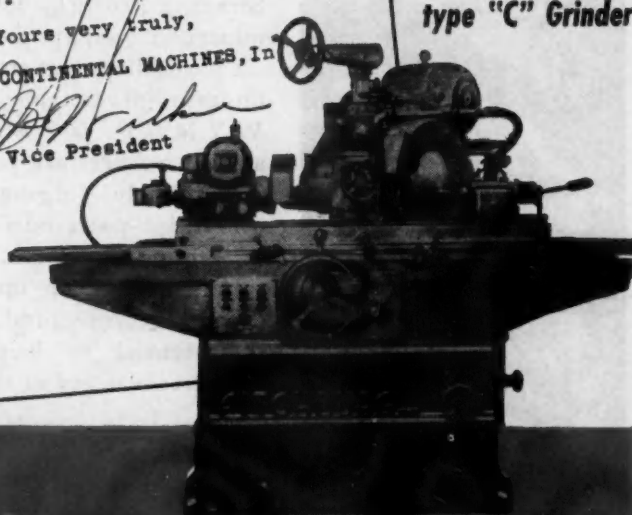
Yours very truly,

CONTINENTAL MACHINES, Inc.

Vice President

JWWilkie.com

Unsolicited letter
received by
Fitchburg regarding
type "C" Grinder



FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — Bowgate Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

Morse Chain Production Facilities Quickly Adapted to War Products

(Continued from page 21)

In the improved method, the forging is normalized, the center hole drilled, then the blank finished all over in two operations on eight-spindle Bullard Mult-Au-Matics. The six 1½ in. holes are drilled, the back face ground on a Norton external grinder, and the 51 teeth cut in a Fellows gear shaper. The teeth now are hardened in the flame hardening machine, quenched, and

drawn in a Homo furnace at 900 deg F for two hours. The hub is ground in a Norton external grinder, two small holes drilled in an Avey drill press, and the keyway cut in a LaPointe machine.

The new method, in addition to speeding up productivity, also produces added gear life since the gear teeth are hardened to 375 Brinell instead of 300.

One of the external gears for a ma-

rine reduction gear is made from a forging of SAE 4820 steel. The blank is finished in two operations using two six-spindle Bullard Mult-Au-Matics. The hub end face is ground in a Blanchard grinder. The gear teeth are rough cut in a Barber-Colman hobber, then finished in a Fellows gear shaper. After cutting the keyway, the gear is heat treated by carburizing and hardening, then it is shot-blasted. The bore is ground on a Heald internal grinder; the hub OD is ground on a Norton external grinder.

The trunnion bearing for a universal joint is of interest, owing to the use of a special drawn steel bar having the proper external contour. The bar is produced in long lengths suitable for feeding in a 3½ in. Cone Automatic. The work is turned, formed, faced, bored, and cut to length automatically in the four-spindle Cone. The operation also includes the formation of a spherical face. The only additional steps required to finish the piece are those of burring.

For an example of a difficult aircraft part we refer to a cylinder head stud which is about 13½ in. in finished length and has an intricately formed contour. Owing to the unusual length of the stud, the original set-up was conventional, with one man tending an automatic machine and feeding out the stock by hand. Today, the job has been vastly improved in productivity by the development of a special feed-out attachment which makes it possible for two operators running three machines to match the output of four machines and four operators with the former method.

These studs are produced from hexagon bar stock in two settings in 1½ in. Cone automatics. On the first machine the long feed-out attachment is located at the fourth position. The first machine produces the studs cut to length and partially formed. The second automatic operation faces the end and drills one end, turns the OD, and chamfers the other end.

The work then is routed to a bench centering machine for forming the radius at the bottom of the drilled hole. This is followed by two operations on LeBlond rapid production lathes—one setting for producing the middle cut; the other for turning the long cut. In each instance the operation is speeded by the use of Kennametal or Firthite tools.

The foregoing gives a few of the highlights of manufacturing operations based upon the development of unique techniques. It will be noted that in each instance a conscious effort has been made to get the most out of the available equipment. And yet, in the process, this organization has succeeded in developing methods which can compete on a favorable basis with anyone producing similar items.

To supplement the word picture we have reproduced some pertinent illustrations taken in various sections of the plant.



Strength, toughness and minimum weight forgings . . . parts that must stand up under unpredictable loads. WYMAN-GORDON skilled workers are producing reliable forgings for every high-powered aircraft . . . around the clock . . . determined to keep up high speed, accurate production so essential to freedom's complete mastery of the air.

WYMAN-GORDON

Forgings Laboratory Controlled

WORCESTER, MASS.

HARVEY, ILL.

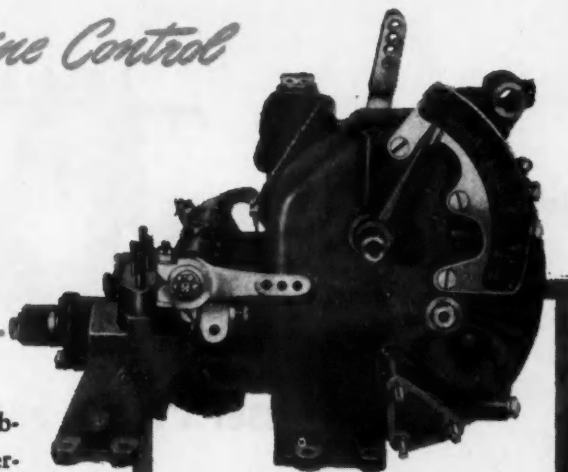
DETROIT, MICH.

Simmonds-Hobson Automatic Engine Control

A STEADY HAND AT EVERY THROTTLE

WITHOUT attention from the pilot, the Simmonds-Hobson Automatic Engine Control assures efficient power-plant operation under varying flight conditions. A notable development in aircraft engines, it is equivalent to a third hand for the pilot—giving automatic control of manifold pressure (boost) and mixture, thus providing engine protection and economy of operation.

Simmonds-Hobson Automatic Engine Controls have been specified for the most advanced types of fighter planes, where they are performing an outstanding job under exacting military requirements. Through continued research and refinement, new and more advanced designs, extending to the propeller governor, spark, and other engine functions, will be available to render increased service for peacetime assignments.



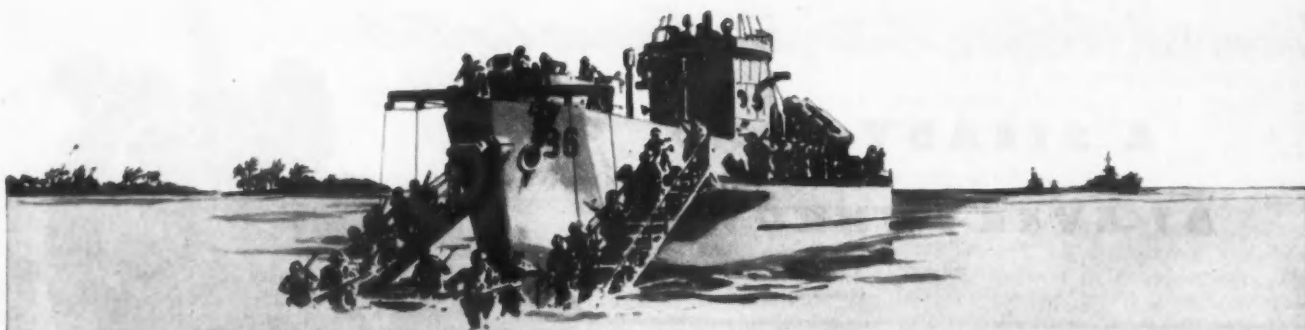
*The Simmonds-Hobson
Automatic Engine Control
Mark 46*

Simmonds Equipment Flies with Every Type of Allied Aircraft

Automatic Engine Controls
Push-Pull Controls
Hydraulic Accumulators
Hydraulic Fuses
Chronometric Radiosondes
Spark Plugs
Self-Aligning
Rod-End Bearings
Cowling and Panel Clips
and Fasteners

SIMMONDS
AEROCESSORIES INC.

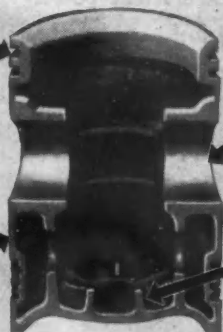
10 ROCKEFELLER PLAZA, NEW YORK, N. Y.
6253 HOLLYWOOD BLVD., HOLLYWOOD, CAL.



This Diesel Piston Should Put Ideas In Your Head

BETTER MACHINABILITY of ArmaSteel lengthens tool life, reduces man-hours of machining time. Close conformity of ArmaSteel castings to final shape reduces chips, increases output, lowers finishing costs.

MIRROR-SMOOTH SURFACE. ArmaSteel may be machined to surface smoothness, and polished to a mirror finish.



BUSHING METAL IS SAVED. ArmaSteel possesses excellent bearing properties—eliminates need for the bronze bushings formerly used.

HIGH STRENGTH AND FATIGUE LIFE qualify ArmaSteel pistons for use in Diesel trucks, locomotives, tanks and marine engines—where pistons must withstand enormous pressure, heat and wear.

Tool Wear Reduced—Machining Time Cut— Production Stepped Up—With

ArmaSteel*

CONSIDER THESE ACTUAL CASE HISTORIES: In automotive camshaft production, the rough turning operation was eliminated, and ArmaSteel's adaptability to selective hardening eliminated the costly carburizing process (ordinarily necessary when forgings were used). • Used for universal joint yokes, ArmaSteel reduced broach load from 11,000 to 5,500 pounds, stopped tool chatter, cut tool costs. • In transmission shifter yoke production, the preferred yoke design was not adaptable to forging, but readily lent itself to ArmaSteel casting. • In the household appliance industry, ArmaSteel is used for many of the parts requiring high strength and wear-

resistance—such as refrigerator compressor unit connecting rods and crankshafts and washing machine gears. • With ArmaSteel replacing bar stock, machining time on receivers for the Browning automatic rifle was cut from 16 to 2 hours.

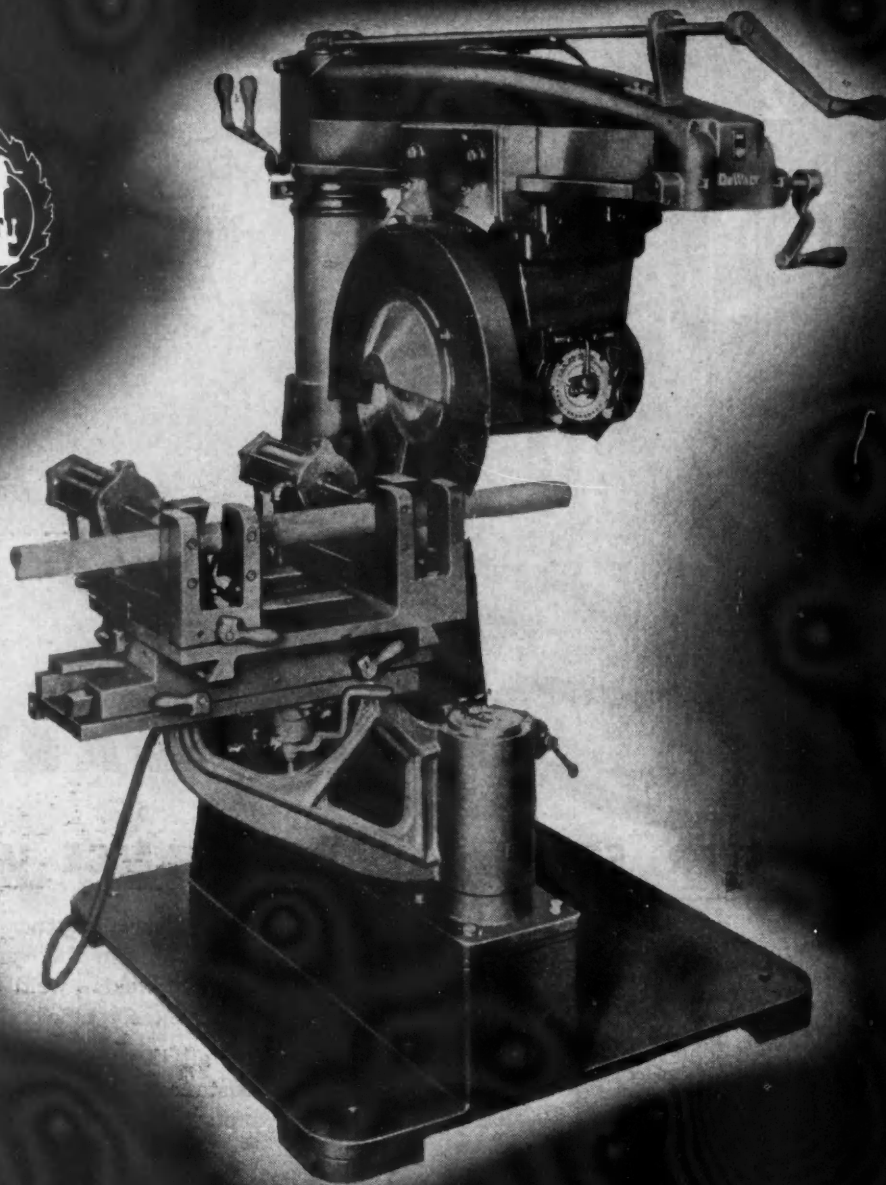
It is entirely possible that ArmaSteel can effect similar savings and improvements in your plant's processes and products. We suggest that you write to us, detailing your requirements.

**Don't Let Down Now—
KEEP BUYING WAR BONDS!**

**SAGINAW MALLEABLE IRON
DIVISION OF GENERAL MOTORS
Saginaw, Michigan**

*Reg. U. S. Pat. Off.

CAST FOR A LEADING ROLE IN INDUSTRY



Metal Cutting Machine

OR CUTTING TUBES, BARS, FORMED AND EXTRUDED SHAPES

This flexible DeWalt Metal Cutting Machine is designed for

all types of straight and angle cut-off operations in both fer-

rous and non-ferrous metals. Write for descriptive literature.

DE WALT CUTTING
MACHINES

LANCASTER, PENNSYLVANIA



ELECTRONIC

Resistance Welding Control

Silent PARTNER

FOR FASTER, STRONGER, RESISTANCE WELDING



VITAL MATERIALS SAVED

Eliminates rivets. No flux or solder required.



INCREASED PRODUCTION

Fewer welds are necessary when all are of uniform strength. Less preparation and finishing required.



FEWER REJECTS

Accurate control of timing eliminates weak welds and burned material.



Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

RESISTANCE WELDING CONTROLS

Electronic control is a natural partner for resistance welding. It gives micro-accuracy in the variables that go into making strong, precision welds—weld time and heat. It controls high currents noiselessly, efficiently.

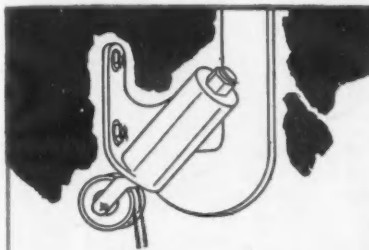
Westinghouse supplies all the necessary equipment for electronic control of resistance welding. Two typical units are illustrated above, mounted on a spot welder.

1 WELD-O-TROL "makes and breaks" heavy welding currents as high as 10,000 amperes with no arc, no noise. Complete absence of moving parts eliminates the noise and maintenance of mechanical contactors.

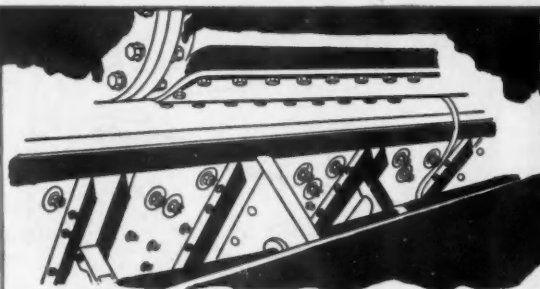
2 AUTOMATIC WELD TIMER controls duration of weld and sequence of electrode operations. Precision control to within one cycle or 1/60 of a second produces welds of uniform characteristics—even in mass production.

Specify Westinghouse controls to improve both production rates and consistency of weld quality. Ask your Westinghouse representative for recommendations and descriptive literature. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

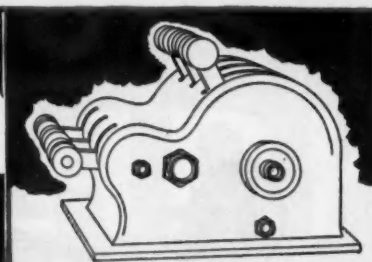
J-21274



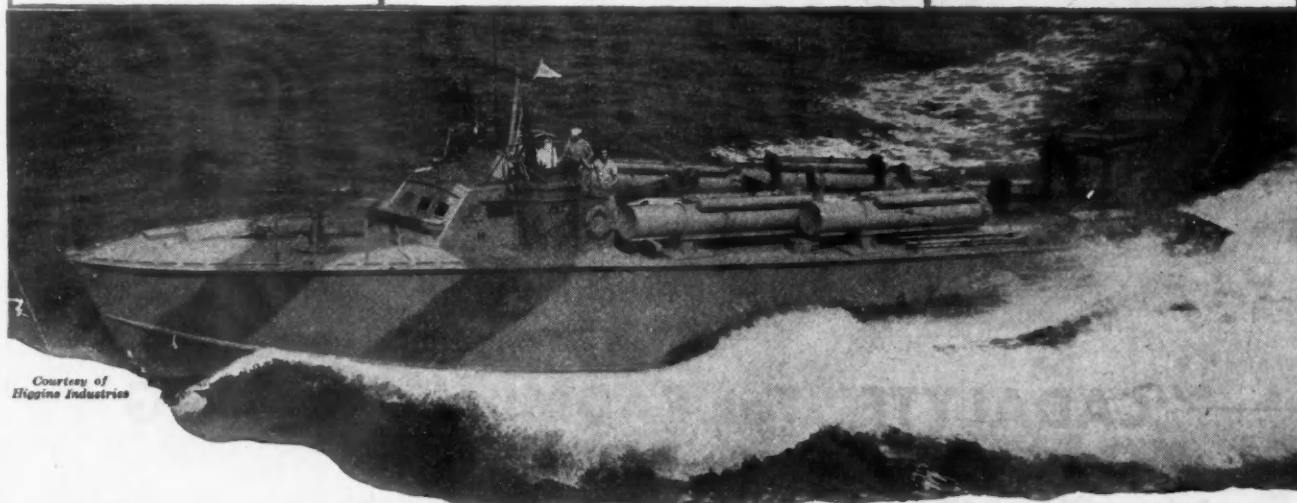
THROTTLE EQUALIZER MECHANISM fastened with Elastic Stop Nuts keeps throttle settings the same, even when the hull is distorted by heavy seas.



ENGINE BEDS. PT boats are a blasting mass of power. Besides, stresses and strains make the hulls weave. So, to hold the engines tight and secure against vibration and other forces, they are fastened down with Elastic Stop Nuts.



ENGINE ROOM SIGNALS and engine controls center in this unit held firm and secure with Elastic Stop Nuts.



Courtesy of Higgins Industries

GRIPPING TIGHT ON THE BATTLING COCKLESHELLS

They're swift. They're light. They're crammed with 4,000 throbbing horsepower that drives them, fighting like demons, through giant seas at breakneck pace.

Naturally they take an awful beating.

Under such shock and vibration only the surest fastenings will hold. That's why throughout Higgins Boats you'll see the famous red collar that marks Elastic Stop Nuts.

These nuts hold fast in the face of the worst vibration. This is accomplished by the elastic collar built in the head of the nut. This collar

grips the bolt — presses itself between the bolt threads and holds tight. The nut can't wiggle. It can't turn. It can't shake loose.

These nuts will work wonders in peacetime uses. They'll make products safer, stronger and longer-lasting. They'll keep production equipment working with fewer inspections, take-ups and replacements.

Get the facts from our engineers. They'll gladly tell you about Elastic Stop Nuts and sit down with you to help work out any fastening problem you have.

ELASTIC STOP NUT CORPORATION

Gentlemen:

Torpedo boats must be built to stand terrific punishment — not only from heavy seas, but from vibration of engines, machine guns and depth charges. Precious time in maintenance and a greater sense of security are gained by the use of Elastic Stop Nuts at all vital points. Weight is also at a premium in PT's as in aircraft and prohibits the use of more cumbersome and less positive locking methods.

Yours very truly,

Jed Sprague

PROJECT ENGINEER, HIGGINS INDUSTRIES, INC.

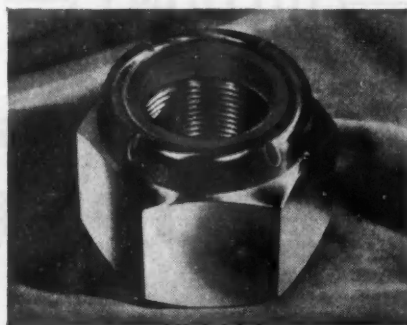
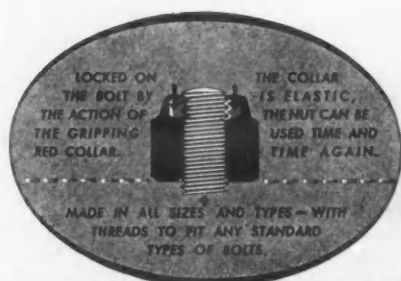
ESNA
TRADE MARK OF

ELASTIC STOP NUT CORPORATION OF AMERICA

ELASTIC STOP NUTS

Lock fast to make things last

UNION, NEW JERSEY AND LINCOLN, NEBRASKA





"CADALYTE" For CADMIUM PLATING

► Designed to simplify cadmium plating, Du Pont "Cadalyte" facilitates production of any type of cadmium plating over a wide range of operating conditions.

"Cadalyte" is a complete plating salt. It contains all the chemicals required for a modern, efficient cadmium plating bath. All that's necessary is to dissolve this salt in water, use the required amount of pure cadmium anodes, and the bath is ready for use.

Deposits of extreme brightness and uniformity can be obtained continuously with

little attention. Maintenance is easy, too, with "Cadalyte" Maintenance Compound, which permits systematic addition of the correct amount of brightener.

★ ★ ★

Plan *now* to adopt easy-to-operate, time- and cost-saving "Cadalyte." We'll show you how it can easily be installed in your plant. For complete details, consult Du Pont Technical Service. Write, telephone or wire *today* to: E. I. du Pont de Nemours & Co. (Inc.), Electroplating Division, Wilmington, Delaware.



DU PONT CHEMICALS • PROCESSES • SERVICE
for **ELECTROPLATING**

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

CLARK TRANSMISSIONS



**BUILT
TO DO A
BETTER JOB**
*at the lowest
cost per mile*

FOR GRUELING HEAVY DUTY OPERATIONS.

TOUGH AND STURDY WITHOUT EXCESS WEIGHT.

COMPACT BUT RETAINING WIDE GEARS.

WIDE VARIETY OF SIZES AND TYPES.

MANY TYPES OF CONTROLS.

SOME vital features of Clark Transmissions, engineered and built into them by a pioneering organization, are:

1. Quietness of operation.
2. Simple design for quick, easy shift.
3. "Spur Gear" and "Helical Gear" types.
4. Sturdy heat treated forks and round bullet-form chamfer for easy, noiseless shift.
5. Balanced design of tooth form, helix angle and face width for quietness and durability.
6. Shielded bearings where needed to control oil flow.
7. Rigid shafts, precision spline fits, long hubs on sliding members for smooth operation.
8. Generously sized parts to meet severest conditions and for conservative tooth loading.
9. Easily serviced and maintained.

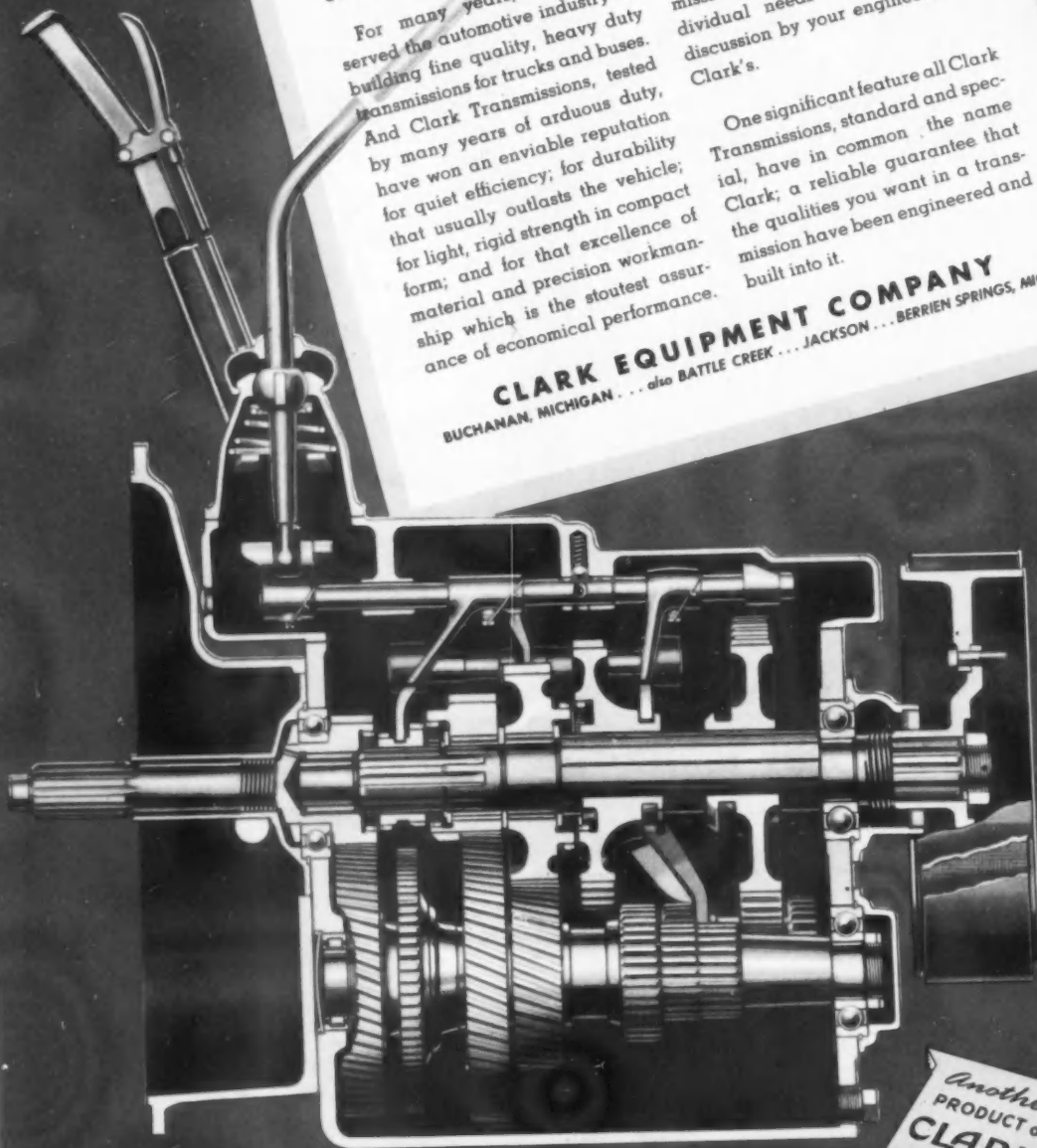
For many years, Clark has served the automotive industry by building fine quality, heavy duty transmissions for trucks and buses.

And Clark Transmissions, tested by many years of arduous duty, have won an enviable reputation for quiet efficiency; for durability that usually outlasts the vehicle; for light, rigid strength in compact form; and for that excellence of material and precision workmanship which is the stoutest assurance of economical performance.

You'll find a full range of types and sizes; or you can get a transmission designed to meet your individual needs—an idea worth discussion by your engineers and Clark's.

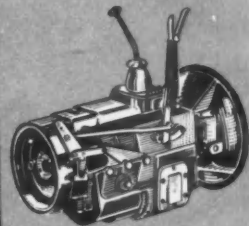
One significant feature all Clark Transmissions, standard and special, have in common—the name Clark; a reliable guarantee that the qualities you want in a transmission have been engineered and built into it.

CLARK EQUIPMENT COMPANY
BUCHANAN, MICHIGAN . . . also BATTLE CREEK . . . JACKSON . . . BERRIEN SPRINGS, MICH.



CLARK TRANSMISSIONS

Some other CLARK products



TRANSMISSIONS



BLIND RIVETING PROCESS



AXLE HOUSINGS



FRONT AND REAR AXLES
FOR TRUCKS AND BUSES



DRILLS AND REAMERS



GEARS AND FORGINGS



ELECTRIC STEEL CASTINGS



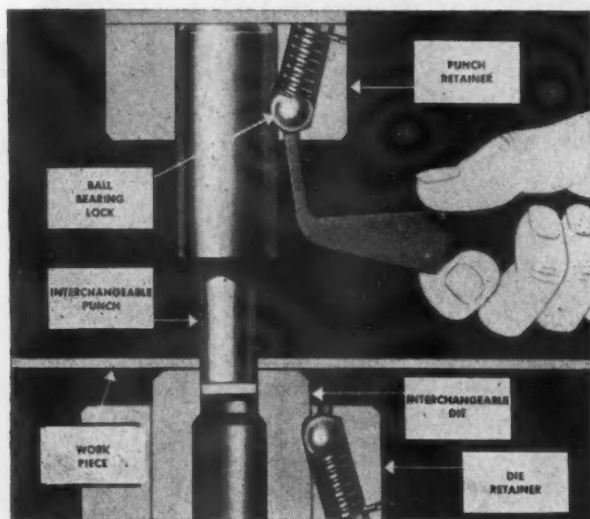
INDUSTRIAL TRACTORS



RAILWAY TRUCKS



METAL SPOKE WHEELS



Showing the method of releasing either the punch or die simply by depressing the ball-bearing with special hand tool provided. Unnecessary to remove die from press.

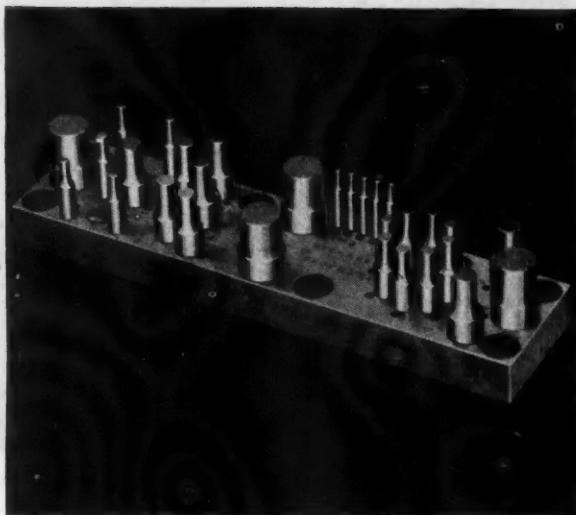


A few of the special shapes produced in R-B Interchangeable punch points. They may be made of any material and in any shape or size to fit your job.

*Service
with a
punch!*

**BY RICHARD BROTHERS—
SOLE PRODUCERS OF THE ORIGINAL
INTERCHANGEABLE PUNCH AND DIE**

For years the patented Interchangeable Punch and Die of Richard Brothers' Division of Allied Products Corporation has been in the service of the metal working industry—delivering a knock-out blow to production delays and high labor costs. Today it has become the accepted standard of efficiency in the field of laminated plastics as well. The wide application and money-saving possibilities of this "first aid" to multiple punching operations is indicated by the illustrations on this page. For a more com-



Special punch retaining plates are made where center distances are too close to use standard retainers. Hole sizes can be changed without affecting plate pattern.

plete preview of "Service with a Punch" write for the R-B catalog. Better still, bring your blueprints or layout problems direct to us.

"IT'S AN ALLIED PRODUCT!"—Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: Sheet metal dies, steam-heated plastic molds, jigs and fixtures, cold forged parts, production parts, aircraft engine and gun parts, and other special precision products.

BUY WAR BONDS

ALLIED PRODUCTS CORPORATION

Executive Office: 4646 Lawton Avenue • Detroit 8, Mich.

★ ★ All four plants have now added a star to their Army-Navy "E" Pennants ★ ★



In the Skymaster . . .

Vital parts of the Pratt and
Whitney engines which power
the Douglas Skymaster are made of Bethlehem
Aircraft Quality Steels.

BETHLEHEM AIRCRAFT QUALITY STEELS ☆





AUTO-LITE

Spark Plugs

for

AIRCRAFT

NEW TYPE CERAMIC

**GIVES MECHANICAL STRENGTH IN
COMPRESSION GREATER THAN STEEL—
HARDNESS APPROACHING DIAMONDS—HIGHLY
RESISTANT TO THERMAL SHOCK!**

Auto-Lite's new type ceramic spark plugs are built to stand up under conditions modern aircraft have to meet—arctic cold, tropical heat, bombing dives from stratosphere to sea level.

Painstaking laboratory development and tests have made possible an aircraft plug with many advantages. At present earmarked for Army and Navy use they will contribute to America's peacetime leadership on the airways of the world.

THE ELECTRIC AUTO-LITE COMPANY
SARNIA, ONT. TOLEDO, 1, OHIO



TUNE IN "EVERYTHING FOR THE BOYS" STARRING RONALD COLMAN—EVERY TUESDAY NIGHT—NBC NETWORK

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

87



YOU SET THE STANDARDS

WE MATCHED THEM WITH

UNBRAKO

Reg. U. S. Pat. Off.

INTERNAL WRENCHING SOCKET BOLTS

Designed expressly for the aviation industry, "Unbrako" Internal Wrenching Socket Bolts are made to extremely close tolerances. Their manufacture is handled exclusively by our largest and best equipped department, where only highly skilled workers with long training and experience in making precision aircraft engine parts are employed. Every step in the manufacturing process is rigidly controlled and close inspections maintain the high degree of precision demanded. Quality is assured by the "Unbrako" name and reputation. The internal wrenching feature facilitates compact designs,—effects considerable savings in weight, material and cost.

National
Aeronautical
Standard

100° FLUSH-HEAD SOCKET BOLTS

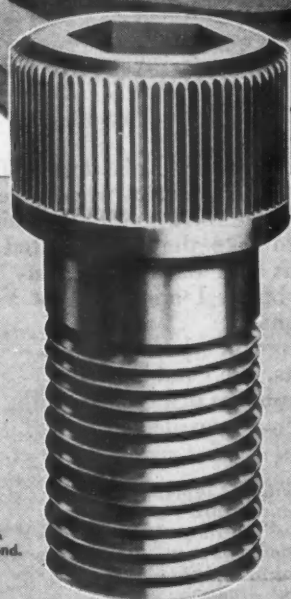
Unlike ordinary flush-heads, "Unbrako" 100° Flush-Head Socket Bolts are made to most extreme accuracy.

OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 611

BRANCHES: BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

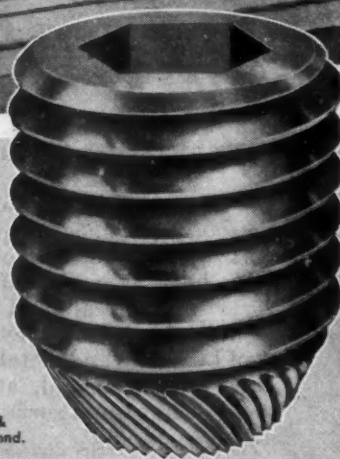


Pat'd. &
Pats. Pend.

KNURLED SOCKET HEAD CAP SCREWS

The use of "Unbrako" Socket Cap Screws with the Knurled Heads eliminates time-wasting finger slip and lost motion, and the pace of assembly can therefore be considerably stepped up. Knurling also permits locking of "Unbrako" Socket Caps. Sizes: No. 4 to 1½" diameter.

Pat'd. &
Pats. Pend.

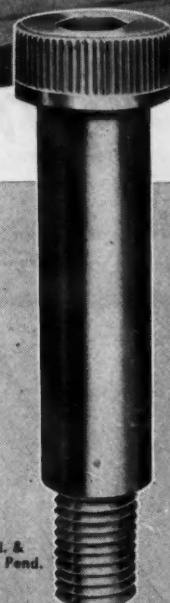


SELF-LOCKING HOLLOW SET SCREWS

When tightened as usual, the knurled points of "Unbrako" Hollow Set Self-Lockers dig in and lock automatically, positively prevent loosening by vibration. Their application therefore effectively reduces maintenance costs and worries. Sizes: No. 4 to 1½" diameter.

**Knurling of Socket Screws originated
with "Unbrako" years ago.**

OVER 40 YEARS IN BUSINESS



Pat'd. &
Pats. Pend.

KNURLED SOCKET HEAD SHOULDER SCREWS

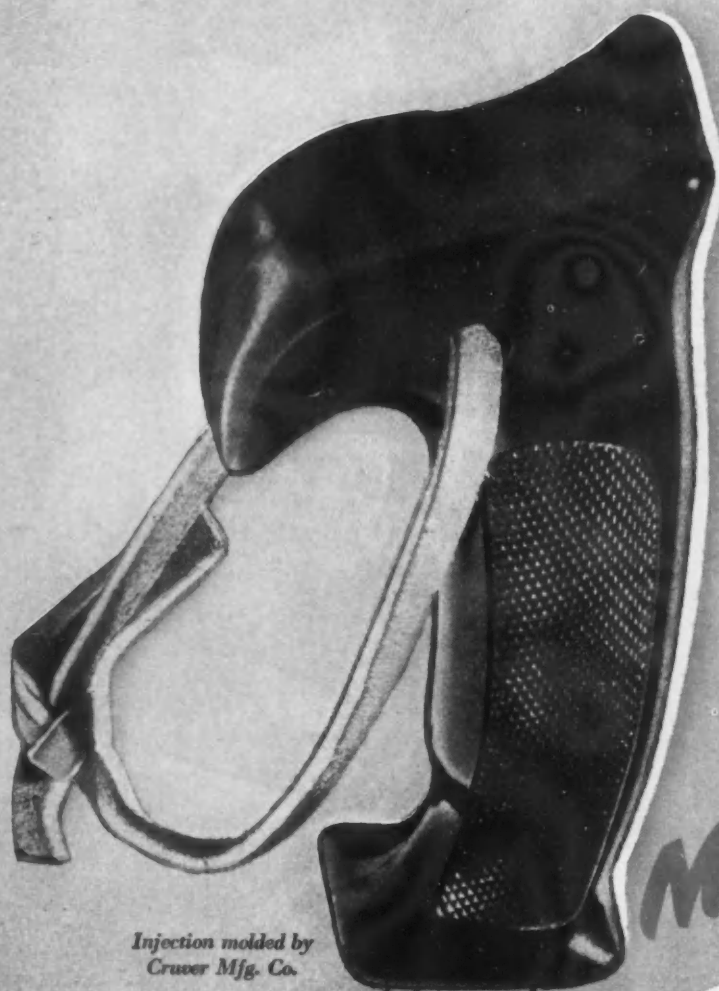
Precision ground, Knurled "Unbrako" Socket Head Shoulder Screws have effective and widespread application throughout the entire industry. Great variety of sizes immediately available from stock.

STANDARD PRESSED STEEL CO.

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

89



Injection molded by
Cruver Mfg. Co.

LUMARITH* SAVES WEIGHT

Lumarith gives the aircraft designer an effective means for reducing airplane weight. Lumarith, used directly or in combination with metal can save as much as 50% of the weight of light alloys. Furthermore, Lumarith is comfortable to the touch in coldest weather—has surface permanence regardless of color or degree of transparency—and is a safe electrical insulator.

MACHETE
WITH THE STEERING WHEEL GRIP

Toughness, that has made Lumarith plastics the first choice material for steering and control wheels, gets a shakedown test on this jungle road builder. In this application, Lumarith has to take the concentrated punishment of moisture, heat and hard usage. Injection molded over the steel blade, Lumarith must hold fast under difficult conditions.

For aircraft and automotive control wheels, grips, railings, cable pulleys and brackets, the combination of Lumarith and metal disposes of problems of strength and structure, and, at the same time provides for hand comfort and surface permanence.

The technical service division of Celanese Celluloid Corporation has accumulated data of interest to aviation manufacturers and automotive designers. Your inquiries concerning the full range of Lumarith plastics—their properties and applications—are invited. Celanese Celluloid Corporation, The First Name in Plastics, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16.

*Reg. U. S. Pat. Off.

Lumarith*
A Celanese Plastic*

TUNE IN
Celanese* Hour—
"Great Moments
In Music"—
Columbia Network,
Wednesdays, 10 P. M.,
E. W. T.

Which RECESSED HEAD SCREW DOES THE AVIATION INDUSTRY *Okay?*



IT'S **PHILLIPS** ←



IT'S GOT TO BE RIGHT! The aviation industry knows its engineering... knows the answers to production efficiency. That's why most of the leaders in this industry selected the PHILLIPS Recessed Head.

You'll choose the Phillips Recess, too, once you study its exclusive design. You'll appreciate the scientific engineering that makes it so successful. You'll discover

that every angle, every dimension has a purpose — is important to screw driving efficiency and screw strength. You'll agree there's nothing like it!

To end the screw driving troubles that slow down production and shove up assembly costs, specify screws with the Phillips Recessed Head. You can get them in any head style, type or size.

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess... fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.



PHILLIPS *Recessed Head* **SCREWS**

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS



IDENTIFY IT!

Center corners of Phillips Recess are rounded...

NOT square.



Bottom of Phillips Recess is nearly flat...

NOT tapered to a sharp point.

23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Warner Co., Chicago, Ill.

International Screw Co., Detroit, Mich.
The Lamon & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalen Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.

Phelan Manufacturing Co., Chicago, Ill.
Reading Screw Co., Harrisburg, Pa.
Russell Russell & Ward Bolt & Nut Co., Port Chester, N. Y.
Sevill Manufacturing Co., Waterville, Conn.
Shakopee Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

★ cutting down time today...



means cutting down costs tomorrow!

TODAY, time is the world's most valuable commodity. Every time a plane is finished... every time a tank is turned out... we shorten the time between now and "V" Day.

And time will still be vital in the post-war industrial world. Production facilities will be tremendous. Sales will flow to those plants which can produce at low cost.

Here at Acme, our staff engineers are trained to save time for you today and cut costs for you tomorrow. Do you need a special tool? Acme can design and build it. Is there a problem in your production line? Acme engineers may have the answer to that problem.

Acme products, Acme engineers have helped many metal-working manufacturers with their production problems. Why not see what we can do for you?

ACME

Pattern and Tool Company, Inc.

DAYTON, OHIO

FOR VICTORY
BUY
WAR BONDS
AND STAMPS



Army-Navy "E" Award received Jan. 12, 1943. White Star for continued high production achievement received Oct. 30, 1943.

HEAT-TREATED ALUMINUM CASTINGS...PATTERNS...TOOLS...TOOL DESIGNING...PRODUCTION PROCESSING

A new approach

TO FINISHING

THE IDEAL POSTWAR PROTECTIVE FINISH



Dries in air in a matter of minutes
—no drying equipment necessary.



Unmatched in color possibilities.



Tough, brilliant, durable, flexible,
resistant to water and chemicals.



Easy to apply—on wooden or metal
surfaces—by spraying, dipping,
tumbling, or roller-coating.

Hercules makes no finished
lacquers, but concentrates
entirely on the production of
high-quality nitrocellulose.

CL-43

RIGHT NOW important developments definitely indicate a complete new approach in the field of finishing . . .

Experimental projects designed to increase the *solids content* of nitrocellulose formulations show promise of success. This will reduce the number of coats necessary—*sharply cut the over-all cost of finishing*.

Furthermore, and this is especially interesting to manufacturers “changing over” or developing new products . . . nitrocellulose lacquers *air dry* in minutes, do not require the installation of expensive baking or drying equipment.

Yes, there are many reasons why many finishers are awaiting the coming events in nitrocellulose lacquer. Keep in touch with your lacquer supplier.

HERCULES

CELLULOSE PRODUCTS DEPARTMENT

HERCULES POWDER COMPANY
INCORPORATED

964 Market Street, Wilmington 99, Delaware



Keep that guard up, America.

* One opponent out means there's one left to beat. * We can only win by two knock-outs. * Meantime, the cannon, steam and diesel engines, heavy machine tools from General Machinery Corporation are in there punching.



GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION

THE VILLAGE SMITHY HAD ITS

Supercharger

SUPERCHARGING — Does this word conjure up visions of airplanes far up in the stratosphere? Developed so much by the war, that use, has indeed given superchargers a "lift" and a glamor far above that of ordinary blowers.

The principle of the supercharger is not new, nor limited to augmenting sub-atmospheric pressures. The Egyptians of 1500 B.C. used mechanical blowers in the form of leather bags to produce a fierce fire for metal working. The village blacksmith "supercharged" his forge with what he called a bellows.

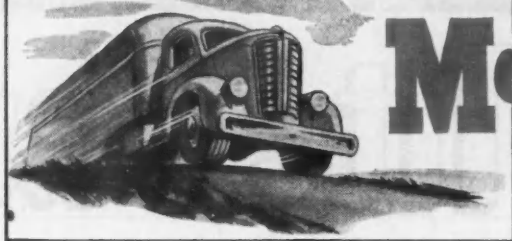
The sole function of the bag blower, the blacksmith's bellows or the modern supercharger was and is to burn fuel faster by delivering air of greater density to the point of combustion. With more fuel burned per stroke the diesel, gas, or gasoline engine generates more power. Results:—

Up high — restores sea level power.

On the ground — gets more power out of an engine and enables a small engine to do the work of a larger one.

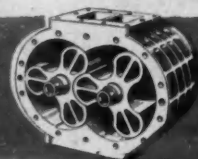
It is not too soon to ask McCulloch, pioneers in modern supercharging, to show you how supercharging can step up the power of your internal combustion engines.

A Supercharger gives heavy trucks that extra power over the hills . . . that "lugging" ability for carrying heavier loads faster over any roads.



McCULLOCH ENGINEERING CORP.
Milwaukee 9 Wis.
 DIVISION OF BORG-WARNER

McCulloch's simple design of precision-fitted and sealed impellers insures efficient, service-free supercharging.



Built to last longer

.... EVEN TO THE OUTER BRAID

Ever notice the way Titeflex is made? When you do, we think you'll agree that it's the most practical, most economical oil and fuel line made.

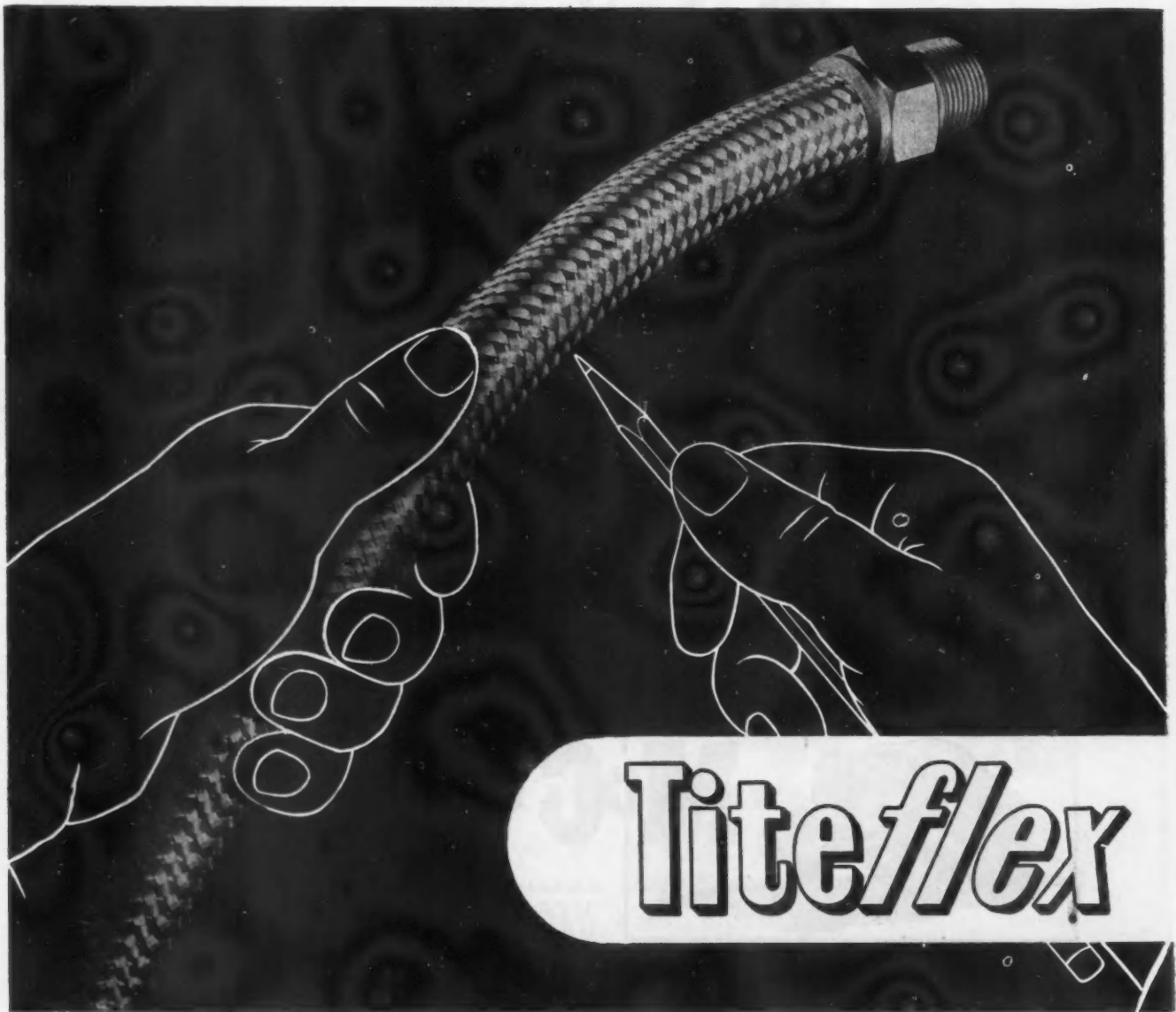
- First of all, it's *all metal*. Unlike other fuel lines, it cannot be damaged by the action of gasoline or oil. Then, it's *fully flexible* — to take excessive amounts of vibration; *heat resistant* — to withstand high temperatures; and *inherently tight* to eliminate frequent replacements.

- Titeflex is built to *last* — and as further evidence, notice that the outer braiding is

not merely a jacket simply slipped into place after the line is made. It's an actual part of the line itself — woven *onto* the line to assure greater strength, greater ability to "take it."

- The use of Titeflex oil and fuel lines identifies your product as one built for longer, more economical service. While the use of Titeflex is today restricted to essential transportation, it's time to learn now how Titeflex can play a vital role in your post war planning. Write today for complete information and data — and the help of the Titeflex engineers.

TITEFLEX, INC.
507 Frelinghuysen Avenue,
Newark 5, New Jersey





The Tasks of Peace . . . The Preparation For the Demands of War

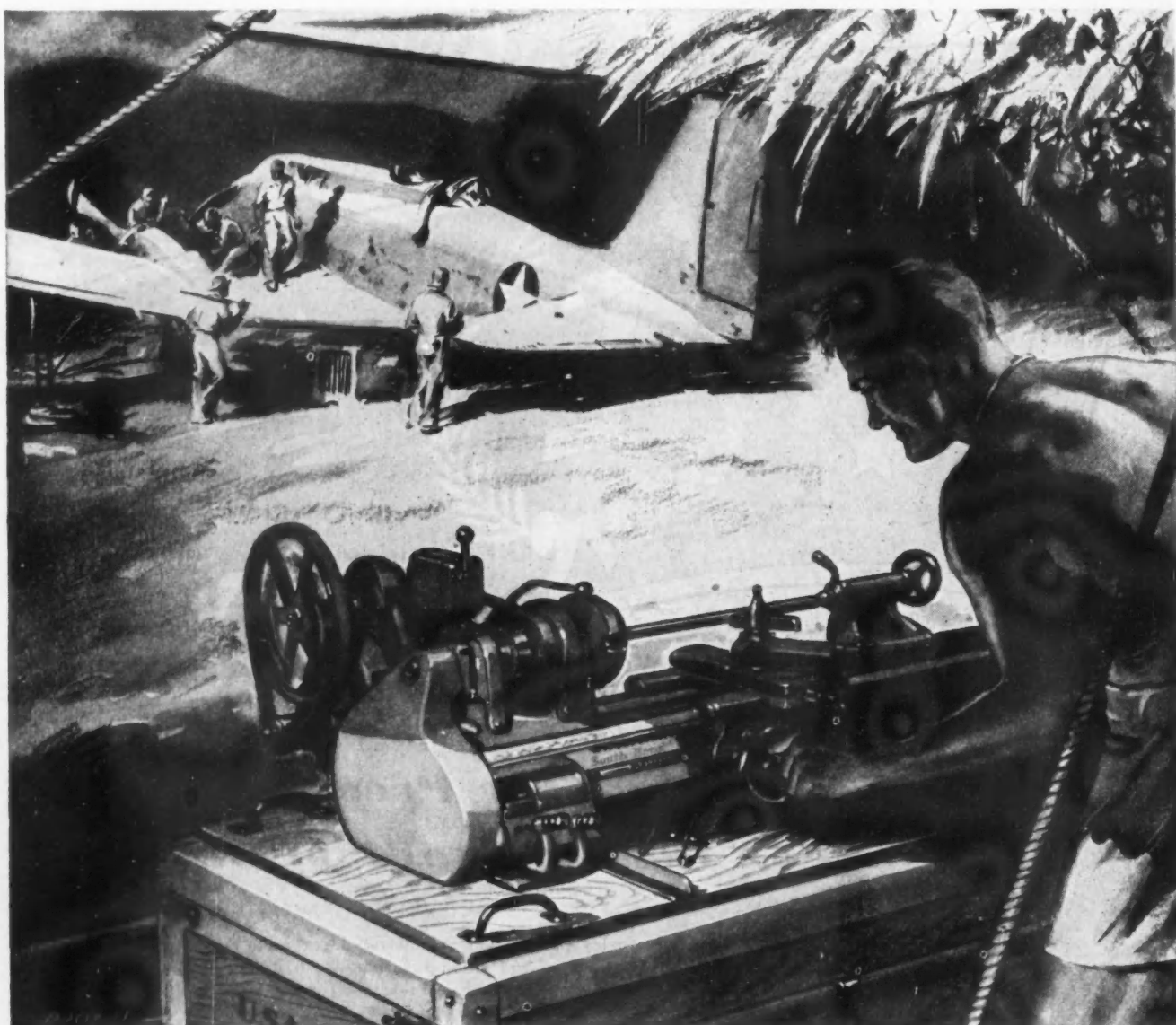
Before the war, King-Seeley Corporation manufactured precision products in large volume for the automotive and allied industries—such items as gauges, speedometers, interval timers, governors and other comparable units.

The knowledge acquired in time of peace is now devoted to the production of war material for our Armed Forces. King-Seeley Corporation is, and has been, for the past two years, supplying a variety of ammunition components and other war items in ever increasing quantities; items of such nature and in such volume that present production schedules are possible only because of the skill and experience acquired in peace time.

That King-Seeley Corporation has succeeded in meeting and continuing to meet its war production demands in both quantity and quality is attested by the Army-Navy "E" pennant awarded in May, 1942, and which now carries three stars.



**KING-SEELEY
CORPORATION**
ANN ARBOR  MICHIGAN



The Flying Lathes of the Air Corps

*Buy
War
Bonds!*



One of the toughest jobs of the Air Corps Technical Service is to get disabled planes back into the air when they have been forced down in remote locations. No matter where the plane is grounded, skilled technicians must get there quickly with all the tools and equipment required to make emergency repairs.

Precision machine operations are sometimes required—so the Air Corps is prepared to fly a Precision Lathe wherever a plane can land. Packed in special, lightweight cases and fitted with accessories for doing a variety of work that would surprise you, these flying lathes are an important part of the Air Corps' emergency service equipment.

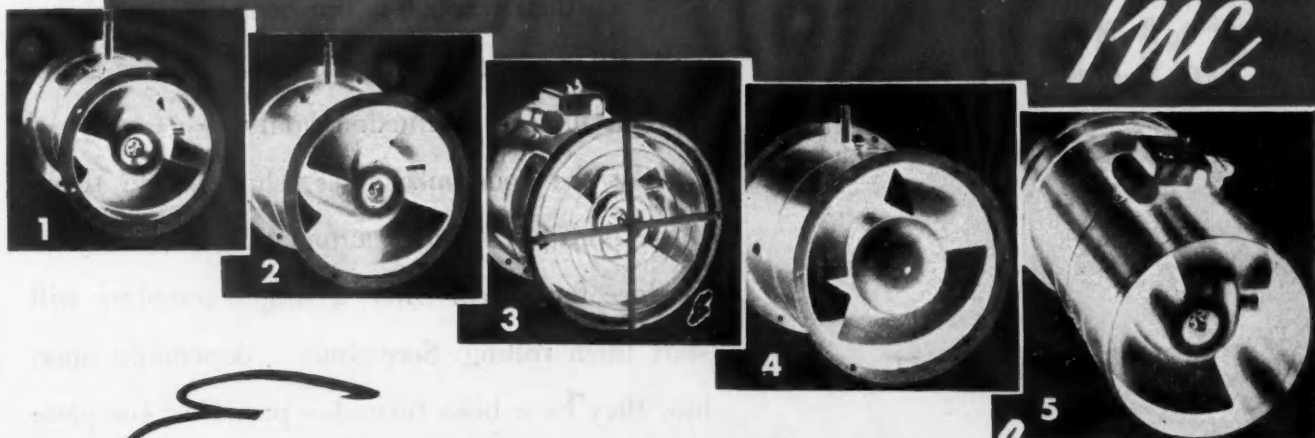
We are proud that South Bend Lathes have been selected for this important service—one of many vital assignments that are keeping South Bend Lathes busy for the duration.

SOUTH BEND LATHE WORKS
SOUTH BEND 22, INDIANA LATHE BUILDERS FOR 37 YEARS

THE SOLUTION

DYNAMIC AIR ENGINEERING

Inc.



TO

Economical

AIR MOVEMENT

① M-5 MARINE. Diam. 5"
190 C.F.M. @ $\frac{1}{2}$ " S.P.
Wt. 5 Lbs. .05 H.P.

② M-6 MARINE. Diam. 6"
450 C.F.M. @ $\frac{3}{4}$ " S.P.
Wt. 6 Lbs. .15 H.P.

③ 586-B AVIATION.
Diam. 6" Wt. 5 $\frac{7}{8}$ Lbs.
425 C.F.M. @ $2\frac{1}{2}$ " S.P.

④ M-7 MARINE. Diam. 7"
750 C.F.M. @ 2" S.P.
Wt. 7 $\frac{1}{2}$ Lbs. .46 H.P.

⑤ 586-SCB AVIATION.
Diam. 6" 2-Stage. Wt.
8 Lbs. 250 C.F.M. @
5" S.P.

Dynamic Air axial flow fans are designed for high efficiency in air delivery, with an accompanying economy in weight and bulk. They move air at pressures once considered strictly limited to capacities of centrifugal blowers. Yet they are so compact in construction that they can be adapted to the most precise requirements of space and weight limitations, while the H.P. input of their high-speed motors remains nominal.

Aviation units designed and built by Dynamic Air to rigid air delivery and weight specifications stand approved for

use on Army Aircraft and are in service by the thousands. The space-saving marine units are meeting a rapidly increasing acceptance among designers of light naval craft.

Aside from successfully replacing heavier blowers, axial flow fans have established a wider field in air engineering, and the possibilities for their industrial use are considerable. If you have a puzzling problem of air movement, consult us. We have designed and built special axial flow fans for 11 years. Send for catalog and data.

DYNAMIC AIR ENGINEERING, Inc., 1619 S. Alameda St., LOS ANGELES 21
DESIGNERS and BUILDERS of HIGH EFFICIENCY AXIAL FLOW EQUIPMENT

Specify **AXIAL FLOW FANS**

UNUSED MACHINE TOOL HOURS

—an industrial asset



ACME-GRIDLEY AUTOMATICS
maintain accuracy at the
highest spindle speeds
and fastest feeds modern
cutting tools can withstand.

IT was a smart automobile dealer who first thought of advertising his used cars as “unused mileage”.

“Unused” is not nearly so much of a turn-up-your-nose word as “secondhand”.

Many of the Acme-Gridley Bar and Chucking Automatics now in use were first bought to do a specific job—to turn out parts for tanks and engines and guns. But they are much more versatile than that.

When their war job is finished, these machines will still represent a valuable industrial asset—in their unused production hours.

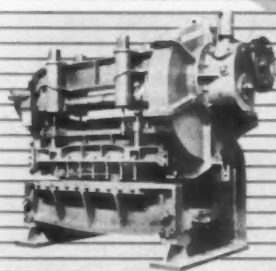
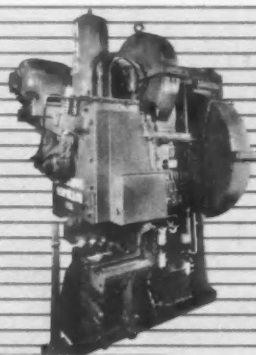
Like the good mechanics who operate them, these multiple spindle automatics are ready to produce for peace. Often a simple retooling will start them rolling. Sometimes—depending upon how they have been treated—partial or complete reconditioning is advised.

To get the most out of this unused mileage—these unused machine tool hours—the retooling or reconditioning should be done by the men who built and tooled these same Acme-Gridley Automatics.

These services are offered for your protection and profit. They are not expensive. Feel free to write The National Acme Company about them.

The NATIONAL ACME *Company*
CLEVELAND • OHIO

**Are you set for
stiffer
competition?**



Model B1 Billet, Bar and Shape Shear (2 3/4" x 2 3/4" mild cold steel.)

Model B6 Billet, Bar and Shape Shear (7" x 7" mild cold steel.)

1" thick x 100" wide Plate Shear.

MACKINTOSH-HEMPHILL

modern shear design

means FASTER, CLEANER,

MORE ECONOMICAL CUTS

Are your shearing costs too high? Mack-Hemp Shears have cut operating expenses in dozens of plants. They are the last word in economical, large volume production. They typify what M-H advanced engineering and plenty of "know how" manufacturing experience can

accomplish. Available in six sizes of billet shears (up to 7" x 7" mild steel billets) and plate shears from 3/8" to 2" thick (up to 156" wide) they give you a definite advantage in meeting today's production schedule and tomorrow's market price . . . Write for details.

MACKINTOSH-HEMPHILL CO., Pittsburgh and Midland, Penna.

Makers of the Rolls with the Red Wabblers

OTHER PRODUCTS—Rolling Machinery . . . Slabs
and Strips . . . Strip Casters . . . Shears . . . Levelers
and Finers . . . Special Equipment . . . Iron Steel Cast-
ings . . . The NEW Abramson Straighteners . . . Improved
Johnson Patented Compressed Cylinder Pins and Supports
Heavy Duty Engine Lathes.

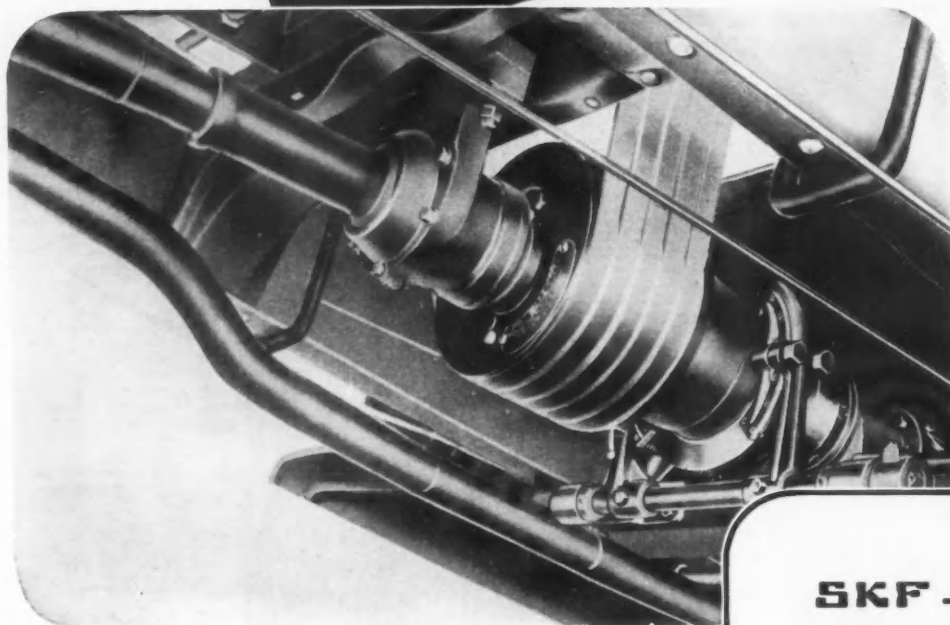
ALL *the* power

GOES TO DRIVEN EQUIPMENT

Everything the engine's got goes into this Davey Propeller Shaft P. T. O. unit that's inserted directly in the truck driveshaft. And that means *all* the power is transmitted to driven equipment. That it has SKF's on moving parts is assurance of a long life, smooth, care-free running and freedom from bearing trouble. The use of SKF's on these units and on Davey Compressors over a period of years is recognition of SKF performance.

5511

SKF INDUSTRIES, INC., PHILADELPHIA 34, PA.



SKF-EQUIPPED

P.T.O. Unit

Built by Davey Compressor Co.



Mister! These Could Be Your Hands...

Right at your own desk, alone and in your own way, you can appraise the value of this modern **CLUTCH HEAD** Screw in terms of speed, safety, and low cost on the assembly lines.

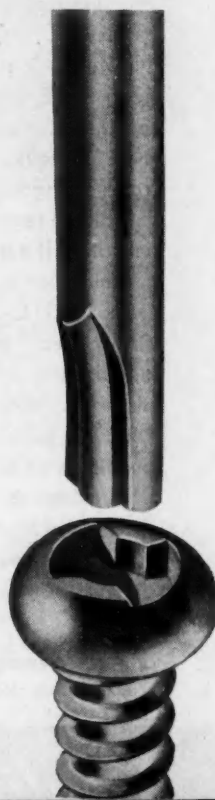
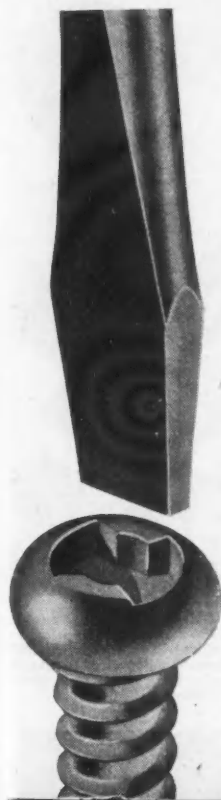
With the assortment of **CLUTCH HEAD** Screws and sample Center Pivot Type "A" Bit . . . mailed to you on request . . . you can check the fact that **CLUTCH HEAD** has everything offered by any other screw, *plus* definite features found in no other screw on the market today. In a word, we are content to let you discover that **CLUTCH HEAD** is a screw that sells itself, on sight, and by any basis of comparison.

On the score of dependable production, you may place reliance on the resources of this organization and on those of responsible Licensees.

For field maintenance and repair, it is important to note that this is the only modern screw operative with the ordinary type screwdriver . . . even with a piece of flattened steel rod in emergency. This feature has proved its value in many phases of the war effort.



Consider the economy of time and money in this Center Pivot Type "A" Bit. It serves through a longer continuous "spell." Full reconditioning is merely a matter of a brief application of the end surface to a grinding wheel.



UNITED SCREW AND BOLT CORPORATION
CHICAGO CLEVELAND NEW YORK



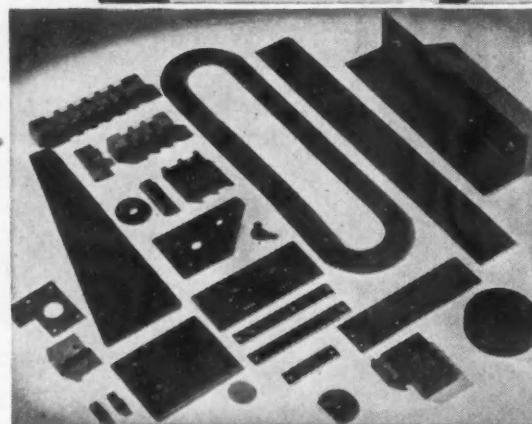
LIGHTER weight, greater speed, higher safety standards, longer life, lower travel and transportation costs . . . have been the lengthening shadows which have forecast our modern methods of overland transportation.

One C-D product, DIAMOND Vulcanized FIBRE, early presaged revolutionary design changes. DVF is a tough, strong NON-metallic, with an extremely favorable, strength-weight factor when compared to metals. It has a natural resilience and great ability to absorb shocks and vibration. It is a good electrical insulator. It is readily punched, machined or formed.

In 1911 C-D introduced DILECTO, a laminated plastic, first called "waterproof fibre." DILECTO has played an equally important part in helping advance transportation methods. Wherever electricity must be controlled C-D DILECTO provides insulation that stands up under extreme conditions of temperature and moisture.

In adapting these and the other C-D NON-metallics to the "What Material?" problems of peace and war, the C-D laboratory has acquired a wealth of "know how" which is at your disposal to help you solve your "What Material?" problem.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



C-D products include THE PLASTICS . . . DILECTO—a laminated phenolic; CELORON—a molded phenolic; DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre; VULCOID—resin impregnated vulcanized fibre; and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

Continental - Diamond FIBRE COMPANY

Established 1895 . . . Manufacturers of Laminated Plastics since 1911—NEWARK 2 • DELAWARE

Exide

HEAVY DUTY BATTERIES



Smoothing the path to victory requires speed and power

In all theaters of war, heavy equipment of this kind is helping to facilitate the movement of supplies . . . to hasten the attack on enemy strongholds. Long hours of continuous work . . . a constant rush for completion on time . . . requires highly efficient equipment that will keep moving under the greatest pressure.

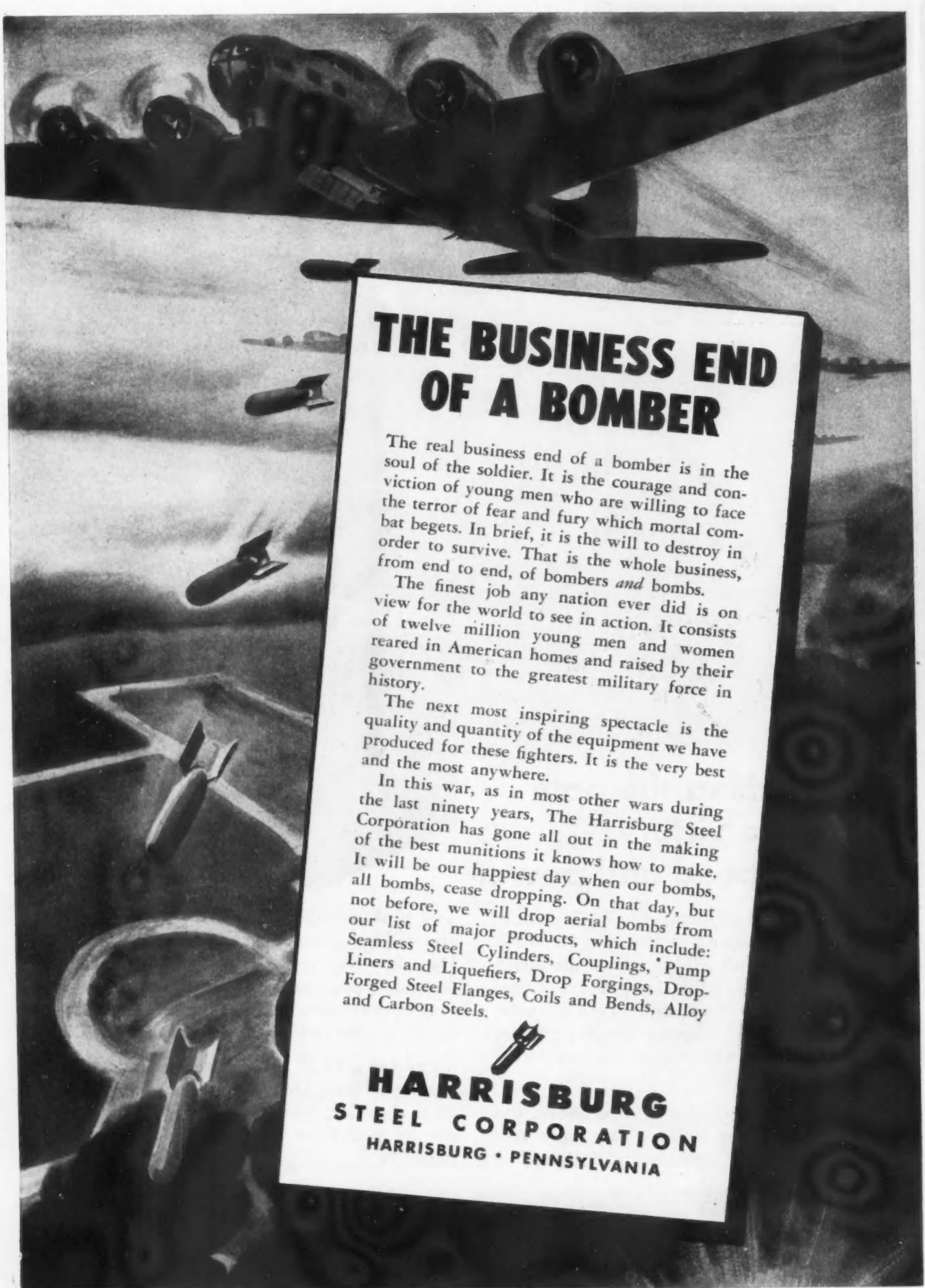
In these "off-the-highway" operations, you would find many Exide Heavy-Duty Batteries. They are specifically designed to

give peak performance in any climate and you will find them in use all over the world. Day after day, regardless of temperature, you can depend on Exides for faster cranking. They are durable and dependable, built for long-life, and are simple to maintain.

Write for a FREE copy of the Exide catalogue on Heavy-Duty Batteries. It tells you what to order, how to order, and how to get the most from your Exide Heavy-Duty Batteries.



THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



THE BUSINESS END OF A BOMBER

The real business end of a bomber is in the soul of the soldier. It is the courage and conviction of young men who are willing to face the terror of fear and fury which mortal combat begets. In brief, it is the will to destroy in order to survive. That is the whole business, from end to end, of bombers *and* bombs.

The finest job any nation ever did is on view for the world to see in action. It consists of twelve million young men and women reared in American homes and raised by their government to the greatest military force in history.

The next most inspiring spectacle is the quality and quantity of the equipment we have produced for these fighters. It is the very best and the most anywhere.

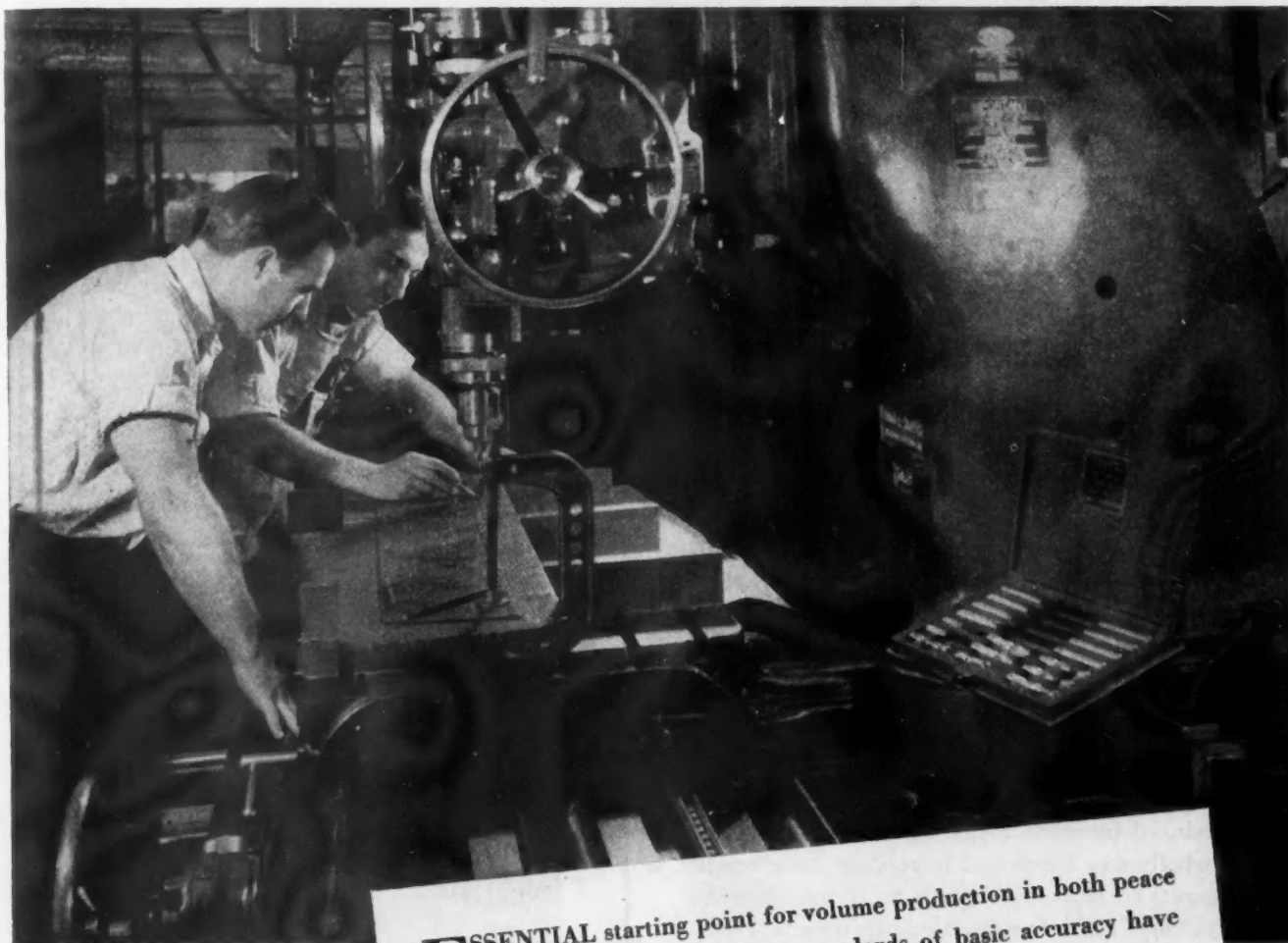
In this war, as in most other wars during the last ninety years, The Harrisburg Steel Corporation has gone all out in the making of the best munitions it knows how to make. It will be our happiest day when our bombs, all bombs, cease dropping. On that day, but not before, we will drop aerial bombs from our list of major products, which include: Seamless Steel Cylinders, Couplings, Pump Liners and Liquefiers, Drop Forgings, Drop Forged Steel Flanges, Coils and Bends, Alloy and Carbon Steels.



HARRISBURG
STEEL CORPORATION
HARRISBURG • PENNSYLVANIA

THROUGH ALL THE RUSH

Unchanging Standards "Hold the Line"



Pratt & Whitney Jig Borer at work ... laying the basic ground work for accurate mass production. In war and in peace, these precision machines perform invaluable service ... produce the jigs and fixtures from which countless other machines and products stem. They also serve as "jig eliminators" on short production runs. Write for details.

ESSENTIAL starting point for volume production in both peace and war, Pratt & Whitney standards of basic accuracy have "held the line"—unchanged, uncompromised.

Despite war pressure for speeded output, P&W standards have not relaxed one iota. There's too much at stake—too many war assembly lines dependent for their speed upon the underlying basic accuracy of machine tools, cutting tools and gages that stem from P&W.

As builders of machines that make machines, P&W will continue to "hold the line" until Victory is won — and then to keep on holding it in the years of world rebuilding that will follow.



PRATT & WHITNEY

Division Niles-Bement-Pond Company
WEST HARTFORD • CONNECTICUT

The latest answer to your wear problem

STOODY 6 HARD FACING ALLOY

WHETHER your wear problem involves heat, corrosion, impact or abrasion, Stooddy 6 hard facing alloy is your most effective solution. Because of its high content of cobalt, chromium, and tungsten, Stooddy 6 lengthens the service life of a wide range of new and worn industrial parts—protects them against all four types of wear.

Stooddy 6 is used to salvage worn exhaust valves, blanking and forming dies, cams, punches, and many other parts. Application of Stooddy 6 results in *increased service "life"*—as much as *2 to 10 times greater* than that of parts not so treated.

Produced by modern casting methods Stooddy 6 is wholly free from sand impurities. As a result, deposits are clean and smooth, and grind readily to a polished finish free from surface defects. Hardness of Stooddy 6 deposits average 42-44 Rockwell C, and this hardness is maintained even at red heat.

Stooddy 6 conforms to Navy Specification 46R5b. It is made in 1/8", 3/16", 1/4", 5/16", and 3/8" diameters. For details call your nearest Air Reduction office. Write Dept. IAA, Air Reduction, New York for (1) descriptive folder on Stooddy 6, and (2) folder describing Exhaust Valve Reclamation.

BUY UNITED STATES
WAR BONDS



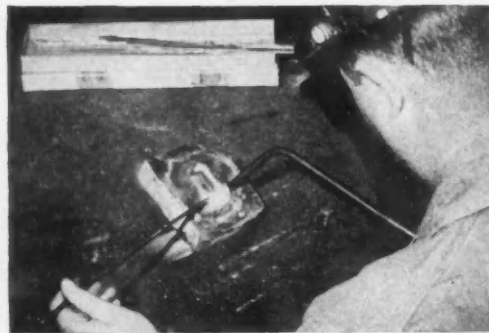
AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS

Offices in all Principal Cities

LENGTHENS THE "LIFE" OF NEW AND WORN PARTS



TRIMMING DIES hard faced with Stooddy 6 outwear plain alloy steel dies as much as 10 to 1.



EXHAUST VALVES for gasoline engines are renewed for service with Stooddy 6. This one operated *4 times longer* than an untreated valve.

AND MANY OTHERS, INCLUDING:

- High temperature, high pressure steam valves
- Valve seats
- Shear blades
- Thrust rings
- Mold blocks
- Knockout blocks
- Feed cams
- Broaches
- Collets
- Needle Valves and Nozzles.



1 SIMPLICITY OF DESIGN SPEEDS
INSTALLATION—PERMITS EASY
REPLACEMENT.

2 SELF-ADJUSTING — AUTOMATICALLY
COMPENSATES FOR MISALIGNMENT,
WASHER WEAR AND SHAFT END-PLAY.

3 SEALING ACTION UNAFFECTED BY
RUST OR SCALE.

Illustration shows
use of Bellows
Seal in typical
automotive water
pump. Note
flexibility.

3 OF MANY REASONS FOR INCREASING USE OF JOHN CRANE *Bellows* PUMP SEAL

This seal is very quickly installed; for it comes as an assembled unit and is simply slipped into position, either end first (the two ends are identical). . . The spring-loaded bellows is *flexible* — maintains a tight seal despite end-play in shaft, vibration, washer wear or misalignment of pump assembly. . . And, since it seals on the end flanges, the John

Crane Bellows Seal is not affected by rust or foreign deposit on the shaft.

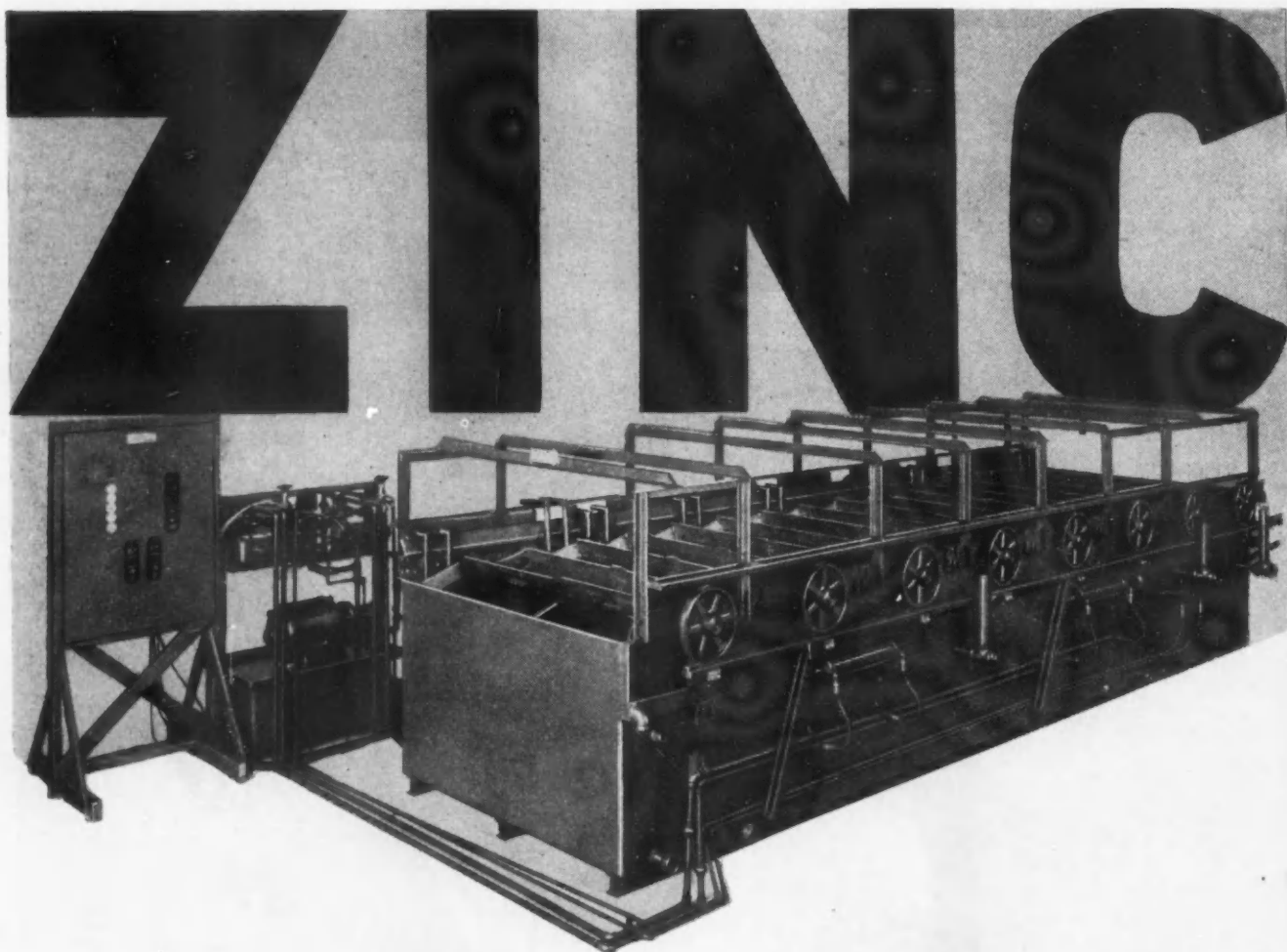
Widely used in centrifugal pumps handling anti-freeze solutions, aromatic gasoline, petroleum distillates and coolant liquids. Exhaustive tests on jeeps, trucks, tractors, tanks and aircraft give high rating to John Crane Bellows Seal construction. Detailed information on request.

CRANE PACKING COMPANY

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

1818 CUYLER AVE. • CHICAGO 13, ILL.

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver



BY UDYLTE

Udylite's years of experience with this practical, inexpensive, protective coating is yours for the asking.

We have the process, nationally known for its efficiency and performance; the equipment, for both plating and dichromating; and the supplies, from chemicals to the efficient ball anode which is an exclusive Udylite development.

The above automatic dichromating machine is a Udylite development for the processing of large quantities of small parts through the complete cycle, from initial rinse to ultimate heat treat. The machine is capable of handling approximately 10 cu. ft. of volume per hour, with excellent uniformity and a minimum of scarring.

Investigate "Zinc by Udylite"—your inquiry will receive our prompt attention.

THE UDYLTE CORPORATION

1651 E. Grand Blvd., Detroit 11, Mich.

Chicago 12
1943 Walnut Street

Long Island City 1, N. Y.
11-16 44th Drive

Cleveland 3
4408 Carnegie Ave.

HELPING DESIGNERS

TO SEE AROUND CORNERS



NEW SF-10R

OVERSIZE ROTATING BEAM
FATIGUE MACHINE

BALDWIN SERVES THE NATION ...
WHICH THE RAILROADS HELPED TO BUILD



BALDWIN PRODUCTS

Hydraulic presses, Testing equipment, Steel forgings and castings, Diesel-electric locomotives, Diesel engines, Metal plate fabrication, Rolled steel rings, Bronze castings, Heavy machine work, Crane wheels, Bending rolls, Plate planers, Babbitt metal, Alloy iron castings, Briquetting presses.

Published reports of studies indicate that specimens of 1" minimum diameter eliminates "Size-Effect" in fatigue.

SPECIFICATIONS: Model SF-10 R Rotating Beam Fatigue Testing Machine Capacity: 0-10,000* inch-pounds by units of 5-inch-pounds (Bending Moment). Specimen size: Diameter—1 inch at 100,000 p.s.i. (larger diameters of lower stresses). Length—adjustable from 3½ inches to 9½ inches. Motor drive—1½ H.P., 220 volt, 3 phase, 60 cycle, 3600** RPM. Length—6'-3". Width—1'-10". Height—4'-0". Net weight—1500 pounds. *Shipping weight*—1900 pounds. *1000 inch-pounds on beam. Additional capacities by four 2000 and one 1000 inch-pounds weights hung on beam end. **Slower speed or multiple speed motors as ordered.

The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia, Penna., U.S.A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.



BALDWIN



SOUTHWARK
TESTING EQUIPMENT

PROTECT

THE CRANK PIN BEARING,
MAIN BEARINGS AND GIBS
ON YOUR PUNCH PRESSES

WITH

LINCOLN

CENTRO-MATIC LUBRICATING SYSTEMS



Here is a centralized lubricating system that will safeguard the heavy-duty bearings of your punch presses. This modern lubricating system will minimize bearing failure and down-time, and will save the valuable man-hours wasted by the out-of-date method of lubricating the bearings one at a time.

It is a simple system consisting of a number of Centro-Matic Injectors—one for each heavy-duty bearing—and a hand-operated Centro-Matic Lubricant Pump. A few easy strokes of the pump handle and a measured amount of lubricant is injected into the main bearings, the crank pin bearing, and the gibs. Ask the nearest Lincoln Distributor for details, or write us.

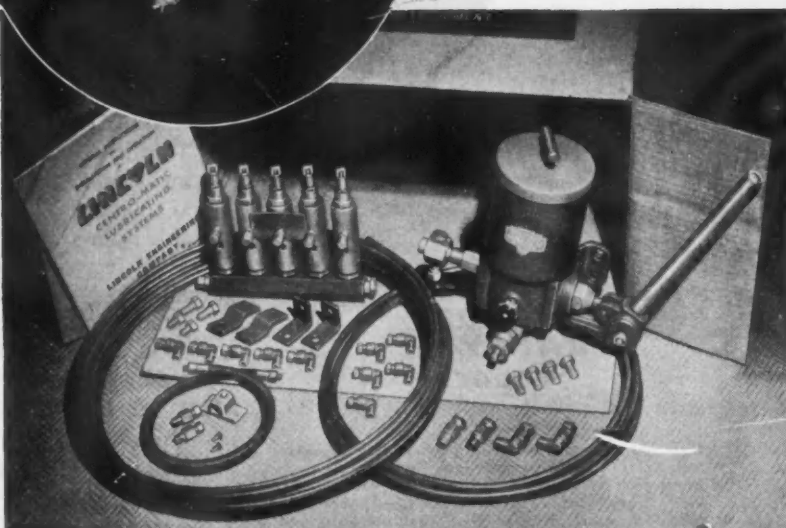
CENTRO-MATIC LUBRICATING SYSTEMS FOR STANDARD PUNCH PRESSES

*Available in Complete Kits for
Convenience in Ordering and Installing*

A Centro-Matic Kit including five injectors, one pump and necessary tubing, brackets, bolts and fittings, ready for installation on a plain, single gib punch press costs \$65.00. Kits for back geared punch presses and multiple gib punch presses are available at proportionately higher prices.

Easy to Install

Centro-Matic Lubricating Systems are simple to install. Complete instructions come with each kit and any handy maintenance man can quickly make the installation. No special tools or outside assistance is required.



144-5

BUY MORE WAR BONDS



LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.



PAGE *Welding* ELECTRODES



Welds that equal the Stainless Steel you weld

Tell your **PAGE** Distributor the type of Stainless Steel you want to weld. The **PAGE-Allegheny STAINLESS STEEL ELECTRODES** he will supply will give you weld metal that equals the Stainless you weld. You can depend on it.

Each of these **PAGE-Allegheny STAINLESS STEEL ELECTRODES** was developed in conjunction with the country's largest producer of Stainless to give you electrodes that

1. give you weld metal that equals the Stainless you weld
2. can be used for vertical, overhead or horizontal welding
3. give you better Stainless welds at lower welding cost

Ask your **PAGE** Distributor to give you all the facts.

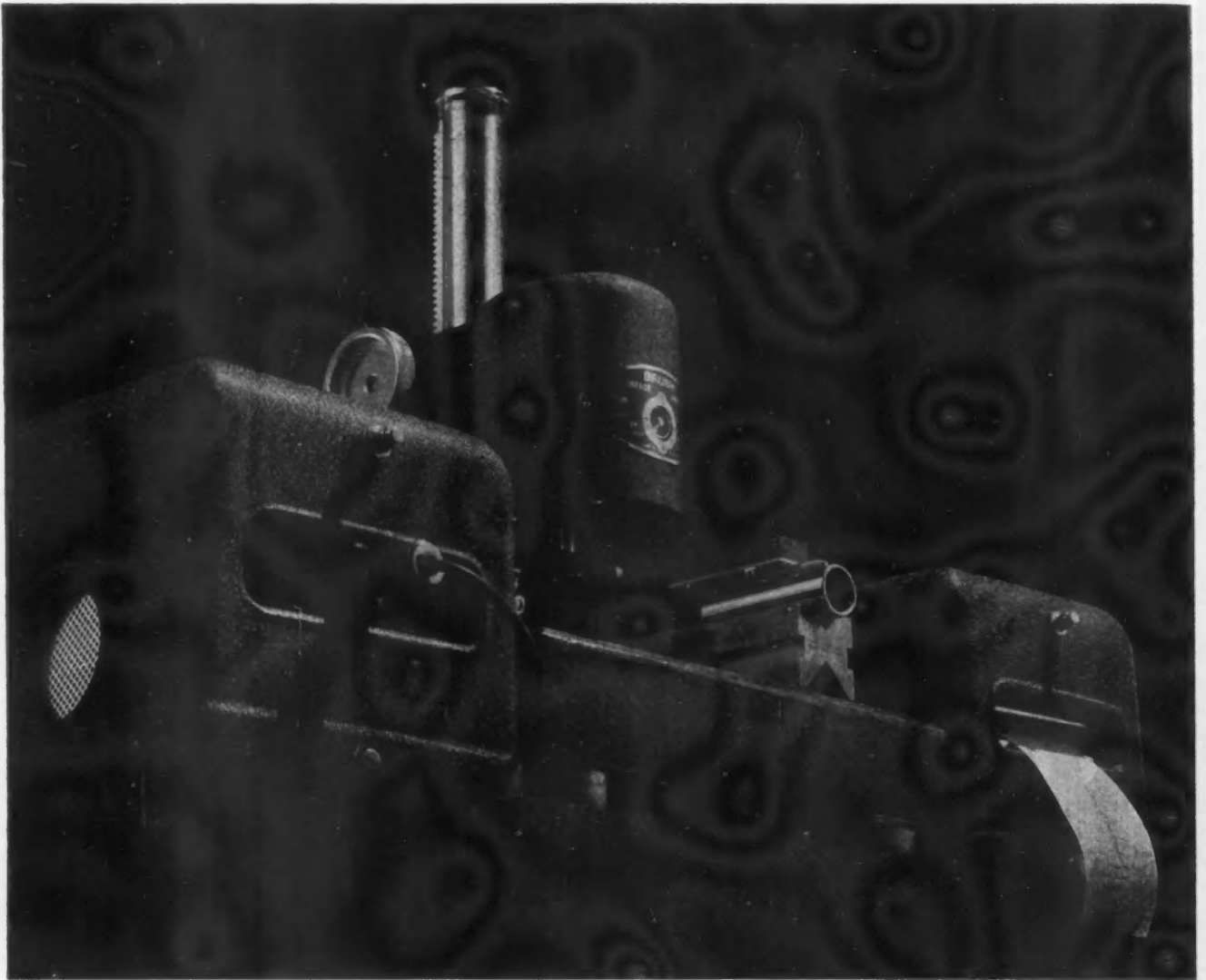
PAGE STEEL AND WIRE DIVISION

Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, Portland, San Francisco

AMERICAN CHAIN & CABLE COMPANY, Inc. BRIDGEPORT • CONNECTICUT



ESSENTIAL PRODUCTS... TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, MANLEY Auto Service Equipment, MARYLAND Bolts and Nuts, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Steel Castings, WRIGHT Hoists, Cranes... *In Business for Your Safety*



Precision STARTS WITH LITTLE THINGS . . . AS LITTLE AS .000001"

Surface smoothness (height, depth, pitch of each irregularity) is accurately measured to a millionth of an inch . . . precision at its finest . . . by the Brush Surface Analyzer.

The movement of the diamond stylus is amplified up to 100,000 times and immediately recorded on a moving paper chart for permanent reference.

Readily operated anywhere by plugging into a 110 volt, 60 cycle, A. C. line.



THE BRUSH DEVELOPMENT CO.

3311 PERKINS AVENUE . . . CLEVELAND, OHIO



NOTHING TO SIT ON . . .



. . . IS SO RESTFUL AS Foamex*

Foamex is Firestone foamed latex—the logical cushioning for bus and truck seats. Besides resting passengers and drivers better, *Foamex* puts your mind at rest about seating upkeep.

Foamex is more comfortable because it combines springy resilience and cushion-y softness ideally—both in one material.

Foamex saves maintenance by simply refusing to sag, pack or lump out of shape. It does away

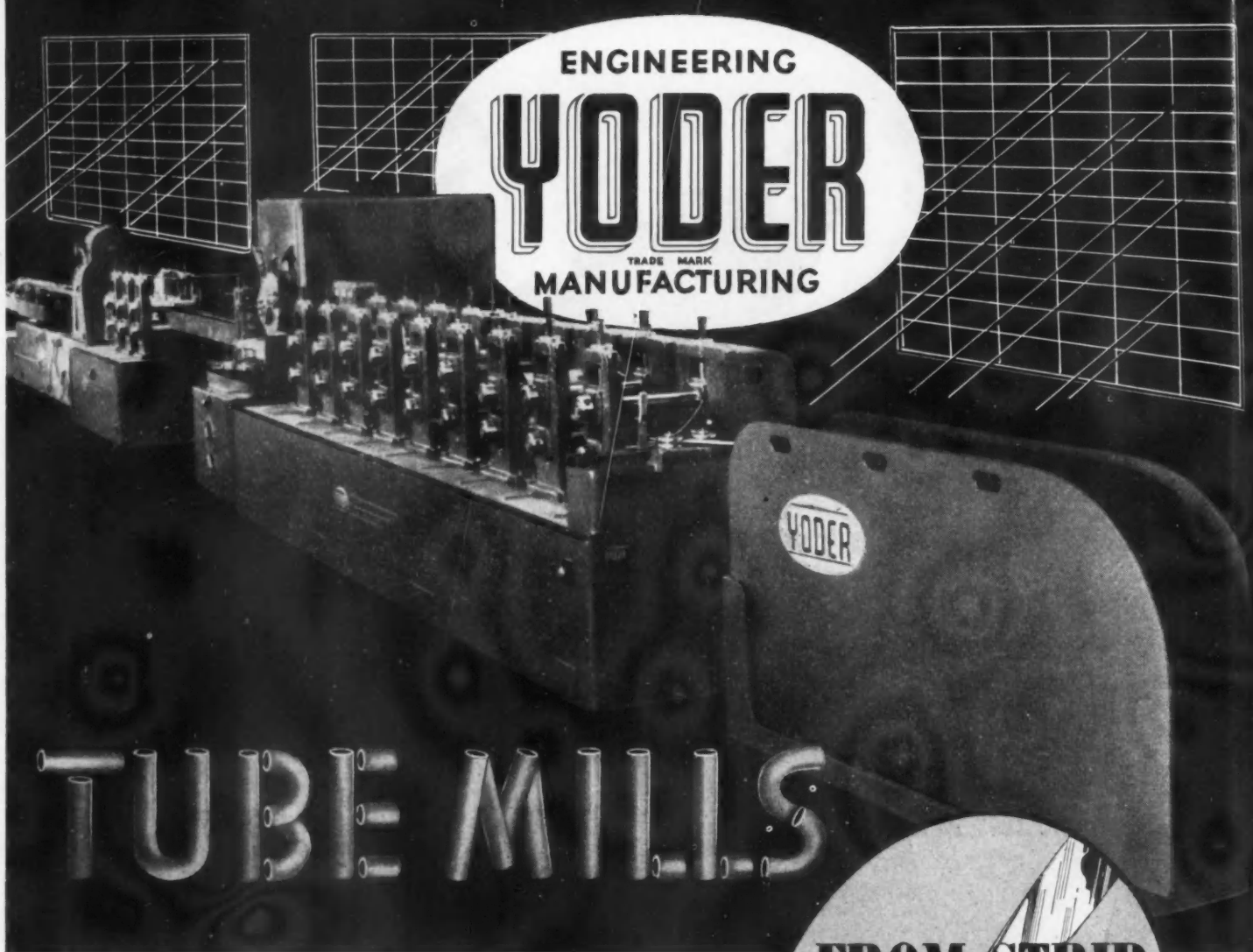
with all old-fashioned parts of upholstering. Replaces them with one molded unit that holds its shape and buoyancy practically forever. Installations made years ago are still standing up perfectly under today's tough usage.

Naturally, *Foamex* production now is for war purposes only. When peace comes, remember *Foamex* means more comfortable seats that stay neat and comfortable longer.

*TRADE MARK

ANOTHER CONTRIBUTION TO
A BETTER WAY OF LIFE by

Firestone



ENGINEERING
YODER
TRADE MARK
MANUFACTURING

TUBE MILLS

COMPLETE. A coil of strip steel is edge conditioned, formed into a butt seam tube, electrically welded, flash trimmed, cooled, sized, straightened and cut to length, continuously, automatically by a YODER TUBE MILL LINE.

YODER EXPERIENCE in the development of Tube Mill Equipment insures your getting the best in patentable features and the latest in improvements.

SATISFIED CUSTOMERS will testify to the soundness of Yoder engineering practices and quality manufacturing policies.

Manufacturers using tubing or parts made of tubing should be interested in a Yoder Tube Mill. Write for information.

FROM STRIP
to
TUBING

The mill pictured will produce tubing up to 4" diameter by $\frac{3}{16}$ " wall. Other standard mills available to make pipe and tubing from $\frac{1}{4}$ " to 26" diameter.

METAL • WORKING • PRODUCTION • MACHINERY

ENGINEERING
YODER
TRADE MARK
MANUFACTURING



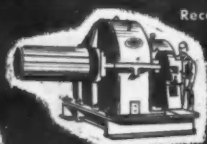
Roll Grinder



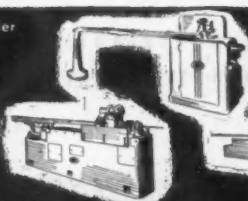
Roll Forming Machine



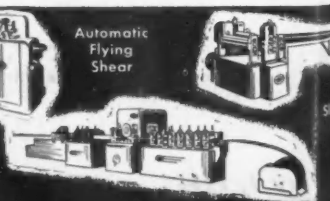
Bender



Recoiler



Flying Tube Cut-Off



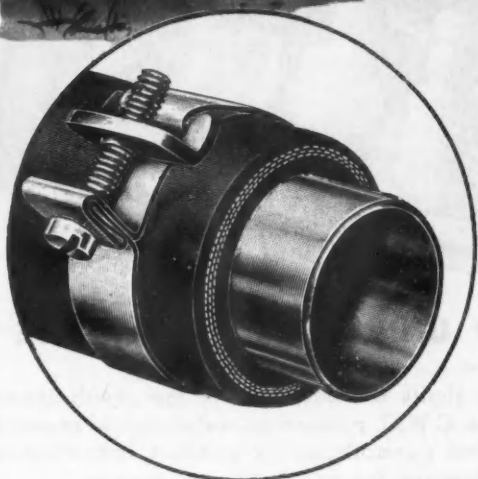
Complete Tube Mill

Automatic Flying Shear

THE YODER COMPANY, CLEVELAND 2, OHIO, U. S. A.

CENTRAL UNIVERSAL HOSE CLAMPS IN

Action!



● Central Universal Hose Clamps are used in the production and servicing of Army and Navy trucks, jeeps, half-tracks, amphibians, cranes, bull-dozers, etc.; also as original and replacement equipment on road-rollers, farm machinery, portable saws, searchlights, marine, diesel and gasoline engines, and for all types of radiator hose.

★ SEND FOR FREE SAMPLE OF
CENTRAL UNIVERSAL CLAMPS

THE *Half Track* DEPENDS ON CENTRAL CLAMP-POWER

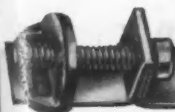
Central Universal Hose Clamps are an important part of America's global war machine. Standard equipment for Army and Navy combat vehicles, they are supplying vital clamp-power with unfailing dependability.

These Clamps are strong enough for every production and service requirement. They are precision built of rustproof, extra heavy rolled steel . . . self-locking . . . cannot strip or loosen . . . able to withstand abnormal pressure, stress, strain and vibration. They also are easier to use in hard-to-get-at places, and can be attached or removed without disconnecting the line.

Furnished flat, one length will fit hundreds of diameter sizes — because Central Universal Hose Clamps are 100% universal!

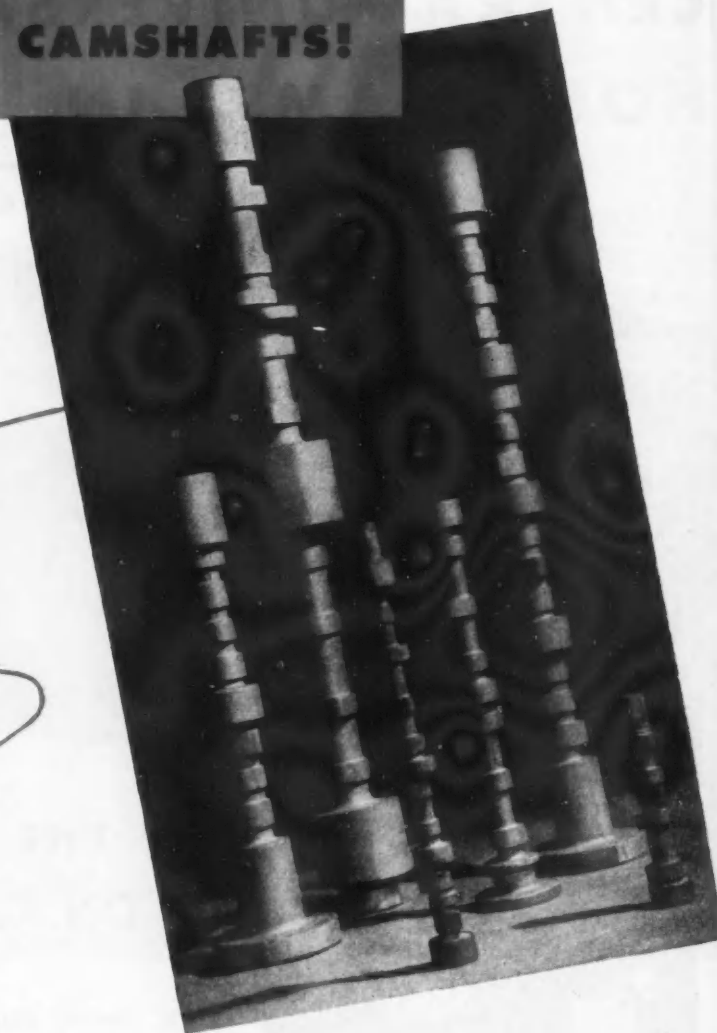
CENTRAL EQUIPMENT CO.

1018 SO. WABASH AVE. CHICAGO 5, ILL.

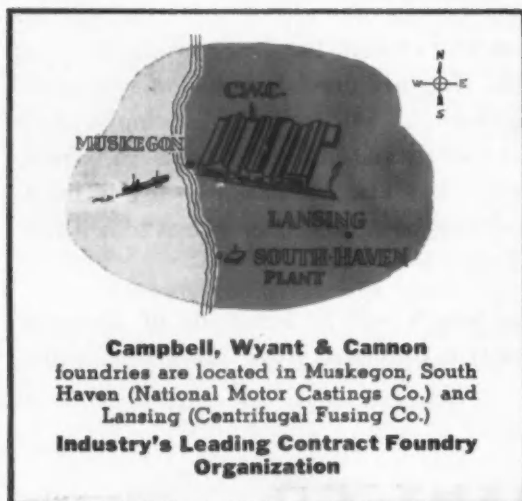


15,000,000 CAST* CAMSHAFTS!

* Cast of Proferall
(PROcess FERrous ALloy)
Electric Furnace Metal



THIS C.W.C. DEVELOPMENT HAS ACHIEVED UNIVERSAL ACCEPTANCE



Proferall* Cast Camshafts are only one of the revolutionary C.W.C. developments. C.W.C. pioneering metallurgical research has opened unlimited possibilities for product improvement and startling opportunities for production economies.

Castings of the new C.W.C. alloyed metals are now common in products used in many fields—automotive, aircraft, agricultural, marine, railway and other metal working industries. Engineers who have taken advantage of the unrestricted freedom of design offered by C.W.C. castings, and the exceptional physical properties of C.W.C. electric furnace alloyed metals have been able to incorporate improvements heretofore impossible.

The use of castings instead of parts fabricated by other methods may open to you opportunities for product improvement with lowered costs.

Consult C.W.C. engineers and metallurgists. Learn about the new electric furnace alloyed metals and C.W.C. facilities for the handling of the largest volume casting requirements.

CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN



it's
a
tough
grind

What a load! And how familiar the merry-go-round! Reminds us of the job the grinder-men are called upon to do. But the going isn't

nearly as tough when Abrasive RED BAND diamond tools are doing the dressing. Abrasive's exclusive

"Oxide-Free Process" which assures useful service from even the final fraction of every diamond... means better

work, more work with fewer set-ups. Abrasive's superior performance is a matter of record, not conversation. Write today for catalog and details.



THE CROWN JEWELS OF INDUSTRY

THIRD GENERATION OF DIAMOND EXPERIENCE.

April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

119



Illustration is from Inland Poster showing an operation in the production of Inland-made Steering Wheels for Aircraft.

Inland's Steering Wheels are a prime example of Inland's mastery of the art of change. Their evolution over the years from wood to rubber and to plastics—and from suave, sleek wheels for passenger cars to wheels engineered and built to properly resist the strain and stress of military needs on Aircraft and Trucks—were problems well solved by our forward-looking engineers. Steering Wheels by Inland are serving on every fighting front.

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio.

Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns and Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.



INLAND



Manufacturing

RUBBER, METAL, PLASTICS

IT'S AS EASY AS

ABC

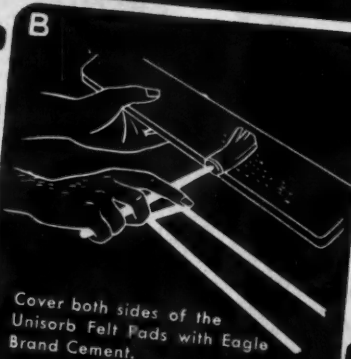
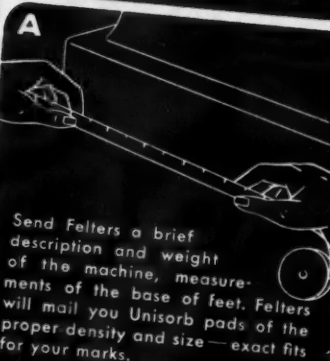
to RELOCATE MACHINES

with UNISORB

NO BOLTS—NO SEAMS NO DAMAGE TO FLOORS

When you relocate machines the Felters Unisorb way, you save *time . . . money . . . labor . . . and floors*. You will find that this 4-way saving is very worth while—in addition to cutting down machine vibration, reducing wear and repair, noise and vibration and improving output in quality and quantity.

An easy way to receive more information about the advantages of relocating machines with Unisorb is to send for a recently published booklet, "Unisorb in the Industrial Plant". Send for your copy today.



The Felters Company

210-R SOUTH STREET • BOSTON, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit • Sales Representatives: Dallas, Los Angeles, Nashville, St. Louis, St. Paul • Mills: Johnson City, New York; Millbury, Massachusetts; Jackson, Michigan

FINE FINISH **FASTER**



BULLARD

Do the products you make have to be held to fine limits? The rigid vertical design of the Bullard Vertical Turret Lathe is assuring fine limits in scores of vital industries. Are you striving to exceed quotas already high, with a dwindling supply of skilled labor? The V. T. L. saves time by cutting with two heads at once . . . saves time between cuts.

Today, as America's production rises to incredible heights, the Vertical Turret Lathes play their part in bringing this war to the "finish" we all desire. Tomorrow, these same advantages will weigh heavily in their owner's favor in the battles of peace-time competition.

BULLARD VERTICAL TURRET LATHES

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

ASSEMBLE THEM FASTER . . . AND CHEAPER

Stitch 'em with Wire!

Ammunition Boxes

Ejection Chutes

Map Pockets

Fire Walls

Shrouding

Packing Harness

Sealing Strips

Trailing Edge Beading



Wire stitching to speed up the assembly of air-

plane and glider parts has advantages over both riveting and welding. It increases production. It lowers cost. It does not require skilled labor.

U·S·S American Aircraft Stitching Wire is tough and ductile enough to form sharp, tight corner bends so that it clinches flat on the underside to provide full bearing on the material. Yet it is so hard that it actually punches a clean slug out of the base metal about the size of the wire itself. Thus it produces a clean hole—with no tearing puncture in the base material nor burring of the hole. No cracking of the material occurs with attendant notch effect that localizes stresses under various load factors.

U·S·S American Aircraft Stitching Wire will penetrate gauges up to .035" for half hard stainless steel—up to .060" for SO aluminum and up to .040" for 24ST aluminum. It is heavily coated with a tightly adhering zinc coating to withstand a minimum of 300 hours salt spray test.

Proved under the toughest operating conditions, this high carbon steel wire is .051" size (with all tolerances under) and has a minimum tensile strength of 290,000 lbs. per square inch. It is put up on 5 and 10 lb. cores ready for mounting on stapling machines. (A 5-lb. core of American Aircraft Stitching Wire makes approximately 10,000 stitches.) We welcome the opportunity of discussing the application of this product to your wire-stitching needs.

ADVANTAGES

Strongly joins metal to metal, or metal to rubber, wood, asbestos, fabric, leather and plastics - without backing strip.

Requires less highly skilled workmen.

Stitches can be applied about 10 times as fast as rivets — about twice as fast as welding spots.

Painting surfaces may be painted before fastening.

Work need not be cleaned before fastening.

Mating and clamping of work is less critical.

Inspection time and skill required are reduced.

Flange distance can be reduced.

Power requirements and initial cost of stitching equipment are considerably lower than for any type of welding.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago, and New York



Columbia Steel Company, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

U·S·S AMERICAN AIRCRAFT STITCHING WIRE

UNITED STATES STEEL

flying **SKY HIGH**

IN THE
**FOUR CORNERS
OF THE GLOBE!**

AIRCRAFT
"Tailor Made" **NUTS**

No greater proving ground has ever tested the worth of any product than actual warfare . . . that's where you will find Aircraft "Tailor Made" nuts making good on all fronts.

From the ground to the stratosphere, under all kinds of stress, strain and emergencies, the aviation industry relies on Aircraft "Tailor Made" nuts to do the almost impossible and they come through. They're made by craftsmen schooled in the art of producing super nuts . . . quality with absolute accuracy . . . not to be confused with the ordinary run of the mine production nuts. There's a big difference. The trend today is for better nuts and the best by any test is Aircraft "Tailor Made" nuts.

If your nut requirements demand precision, strength and unusual quality, drop us a line and we will be glad to work with you . . . no obligation whatever.

Aircraft NUT CORP.
2029 EAST 102nd STREET • CLEVELAND 6, OHIO

★
MIRACLES
in
PRECISION
★

"CHICAGO SCREW"
QUALITY PRODUCTS

are unexcelled for accuracy

For more than seventy years, The Chicago Screw Company has been manufacturing hardened and ground screw machine products—most of them involving the toughest operations.

Our precision parts represent the acme of accuracy because throughout every step of production they are checked, inspected and gauged again and again.

We at Chicago Screw have the background, the engineering experience and machinery—plus the "know how"—to help you with your most intricate screw machine problems.



THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE

CHICAGO, ILL.

There are over

SIXTY THOUSAND

SPERRY EXACTOR REMOTE CONTROLS in use!



Positive
control,
through
a
single
tube

The Sperry EXACTOR Hydraulic Remote Control is a simple, unique, single-tube system designed to control mechanisms over distances up to 200 feet. The more than 60,000 EXACTORS in operation today, solving the remote control requirements of design engineers in many fields, are proof of the thorough engineering and trouble-free design incorporated in this system.

It is accurate to a fraction of a degree and entirely self-contained, reproducing applied motion without the aid of an auxiliary source of power. It presents no installation problem, because both the Transmitter and Receiver are compact and light in weight, and the tube which connects them can be bent around obstacles easily. Vibration does not interfere with its positive, reliable action and means is provided for periodic temperature compensation.

If you have a remote control problem — in the railroad, marine, automotive, aviation, or any of the industrial fields — you will want our completely descriptive booklet. Send for it today.

The Sperry EXACTOR HYDRAULIC REMOTE CONTROL is rated at 400 inch-pounds in one direction, through 55° of motion, and 125 inch-pounds on the return.

FILL OUT AND MAIL COUPON BELOW • NO OBLIGATION



**SPERRY PRODUCTS, INC.
HOBOKEN • NEW JERSEY**

Gentlemen: Please send me, at no cost, a copy of your Bulletin 78-D containing complete details on your EXACTOR HYDRAULIC REMOTE CONTROL.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

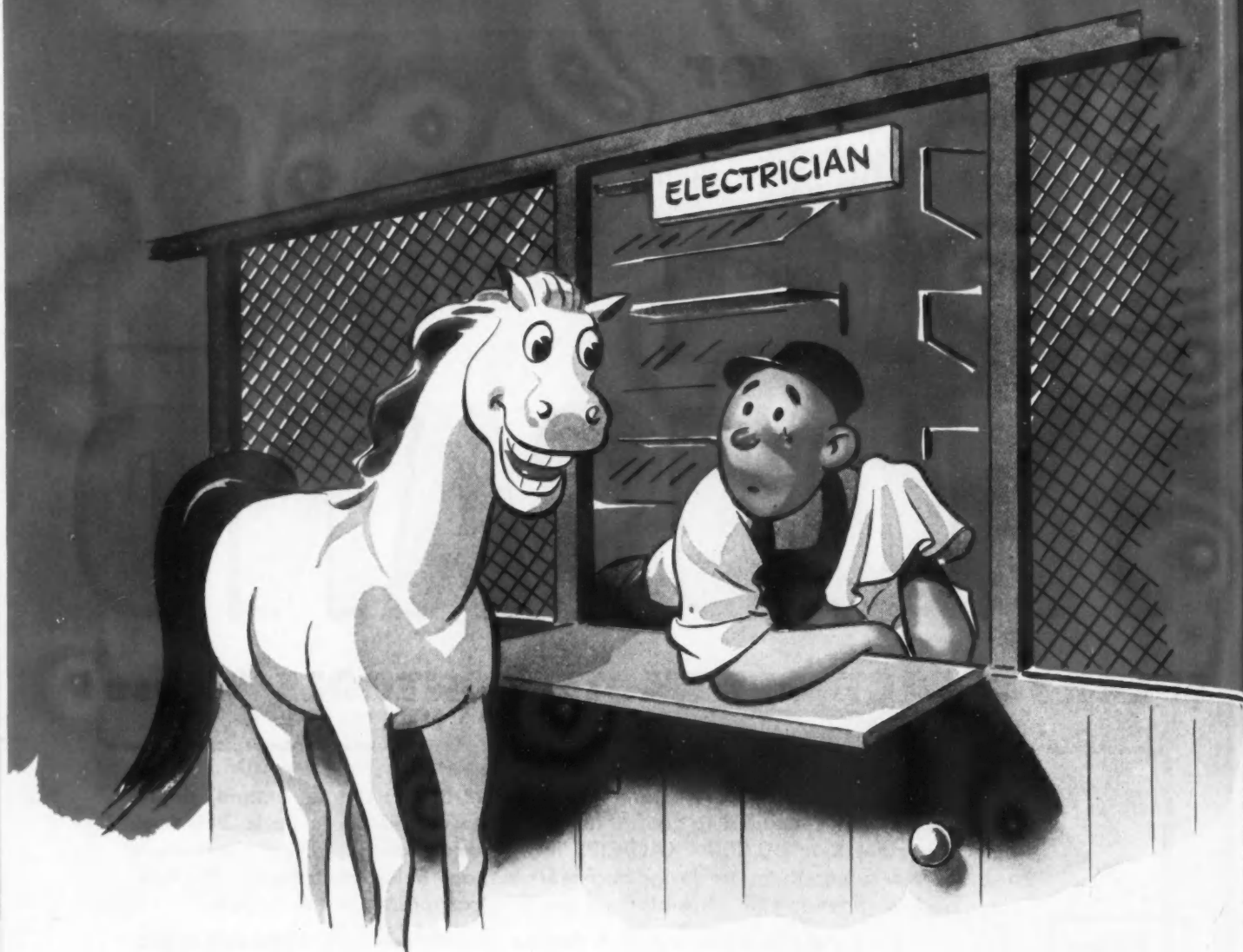
AAI-EHC 444



April 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

125



"Beefing" Won't Help! You need Horsepower by Howell

ELECTRICIAN: Boy, they're running me ragged. Motors coming in with no insulating varnish on 'em, and no phase insulation. Some of 'em out of balance. Doesn't take much to break those babies down.

HORSE: I know. That's why I want to tell you about Howell Motors.

ELECTRICIAN: Yeah! You better know what you're talkin' about.

HORSE: Every Howell Motor is thoroughly insulated. All our rotors are statically and dynamically balanced—they're precision-built, too.

ELECTRICIAN: Good! But do they stay that way?

HORSE: You bet they do! Good materials—copper rotors, high grade bronze or ball bearings—and careful workmanship insure long life. Ask the hundreds of Howell users in the automobile, ventilation and air conditioning industries, in dairies, grain elevators, shipyards, tank plants—they'll tell you . . . you can always depend on Howell Motors for longer, more dependable operation.

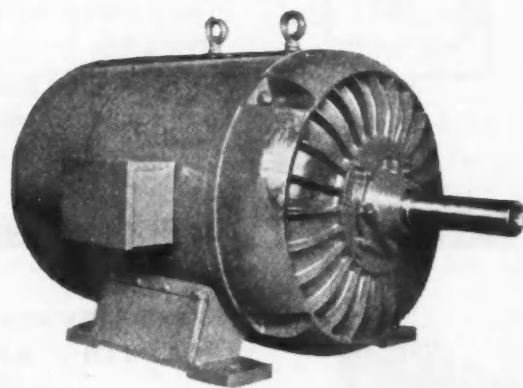
ELECTRICIAN: I know. I've used them. But we haven't got Howells here.

HORSE: Well, quit "beefing" and specify Horsepower by Howell for your next job.

For your specialized or standard motors, phone the nearest Howell representative today, or write the factory. Get the finest motors that money can buy at no premium in price.

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915



Howell Totally Enclosed, Fan-Cooled Motor (shown above). Available through 125 H.P. . . . all working parts are protected against dust, fumes or moisture . . . Fan cooling prevents undue temperature rise (motor overheating) . . . All steel, streamlined housing provides minimum weight and greater compactness of overall length . . . built to N.E.M.A. frame dimensions . . . special horizontal and vertical fan-cooled motors are available.

Also a wide range of other types of motors up to 150 H.P.



Official U. S. Army Signal Corps Photo

THERE'S A *New* HEAVY WEAPON ON THE CUTTING LINES, TOO—IT'S *Super DBL* HIGH SPEED STEEL

Available

IN THESE FORMS

★ Hot Rolled and Forged Bars in all necessary sizes.

★ Ground Bars: rounds in sizes up to 3" dia.—polished, standard ground or rough ground finishes.

★ Hardened and Tempered Tool-Holder Bits in sizes from 3/16" to 1", packed in one or assorted sizes as needed. Also special sizes as may be required.

**NOTHING NEW TO LEARN
IN HEAT TREATMENT
OR SHOP HANDLING**

IN the M-12 Tank Destroyer, above, Army Ordnance has combined the great hitting power and range of the 155 mm gun with the speed and mobility of the medium tank chassis. The result is a weapon that not only can stop any enemy tank now or likely to be in the field, but can blast out land strong-points or sink a ship.

In similar fashion, Allegheny Ludlum technicians have added cobalt to the familiar AL-developed DBL low-tungsten moly analysis. The result, *Super DBL*, is a high speed steel of maximum red hardness for heavy duty work—a material that delivers top performance at the same time that it conserves strategic materials.

Super DBL has been thoroughly proved in service. Use it for your heavy roughing and "hogging"

jobs—it's suitable for anything from hard, gritty materials to tough, heat-treated alloy steels. ● Full information is available in the "*Super DBL* Blue Sheet." Write for your copy, or for the assistance of our Mill Service Staff in selecting the proper grades of AL Tool Steels for your various production jobs.

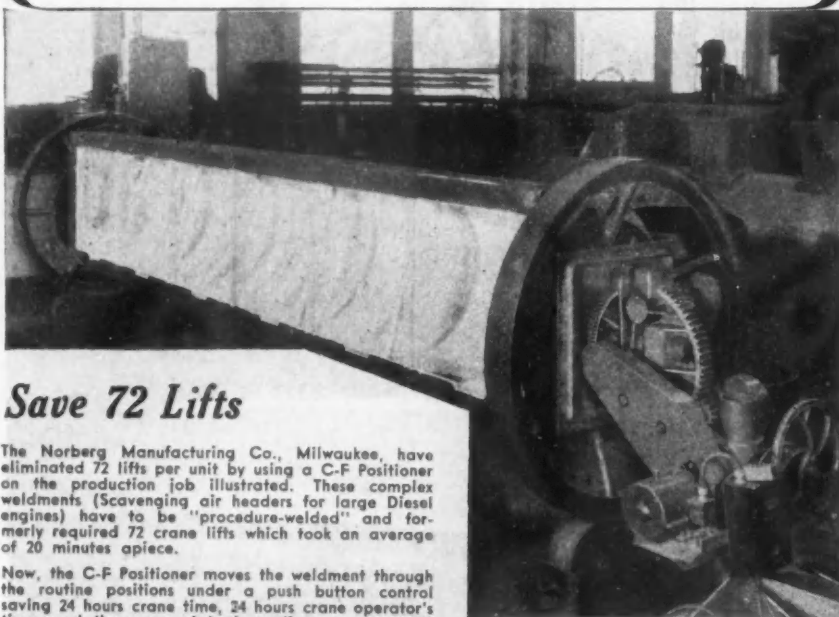
ADDRESS DEPT. ★A1-22



Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-9075...W&D

C-F POSITIONERS



Save 72 Lifts

The Norberg Manufacturing Co., Milwaukee, have eliminated 72 lifts per unit by using a C-F Positioner on the production job illustrated. These complex weldments (Scavenging air headers for large Diesel engines) have to be "procedure-welded" and formerly required 72 crane lifts which took an average of 20 minutes apiece.

Now, the C-F Positioner moves the weldment through the routine positions under a push button control saving 24 hours crane time, 24 hours crane operator's time, and the same of both a sling man and the welder's time per weldment . . . in other words saving three man-days and one crane-day on each header produced.

C-F Positioners come in 6 sizes—capacities to 30,000 lb. All are pedestal mounted, rotate 360° and tilt to 135° beyond horizontal.

Write for
Bulletin
WP-22



CULLEN-FRIESTEDT CO., 1322 S. Kilbourn Ave., Chicago 23, U.S.A.

ATLAS

DROP FORGINGS

are

HELPING

TOWARD VICTORY

ATLAS DROP FORGE CO. LANSING MICHIGAN

Be
100%
With
10%
•
Buy
War
Bonds

Improvements in Parts Distribution

(Continued from page 17)

which compete with GM dealers for service business. Furthermore, such a procedure would take away some of the wholesale parts business which dealers themselves do with independent repair shops. Many new car dealers do as much as 25 per cent of their parts sales with such repair shops. However, the dealers have not pushed this phase of their parts business because they are not too anxious to supply their competitors in the service market. The automobile manufacturer, on the other hand, has a real objective in making factory-made parts available to the independent repair shops because the majority of most makes of cars on the road today are serviced in such shops. One large manufacturer estimates that in the best year, its dealers received only 25 per cent of the parts and service business performed on its make of cars.

General Motors executives have explored rather extensively the possibility of expanding parts sales to jobbers, and a long-time study has been made of the subject. The GM officials also have discussed the subject with various jobbers throughout the country and sounded out opinion on the proposal. However, it appears that no drastic move will be made to inject General Motors suddenly into the jobber distribution setup. Rather it is more likely that the corporation will expand its parts market through some GM divisions that already are engaged in that field. GM, like other car manufacturers, would like a larger share of the replacement parts business, but any move it makes in that direction must be hedged with caution.

Automotive jobbers generally stock only 600 or 700 of the fastest moving parts out of 4000 different parts items. They count on the rapid turnover among these parts to make the business profitable. However, the automobile manufacturer often must carry more than 100,000 different parts to meet the demand from owners of that particular make of car, sometimes dating back to models 15 and 20 years old.

Realignment of manufacturing facilities and warehouse space due to war contracts has resulted in a reduction of the number of parts branches operated by Ford Motor Co. from more than 30 to 17 throughout the country. However, many key dealers, five or six to a district, have been set up on an emergency basis to handle large parts stocks and supply other dealers in the vicinity. Parts distribution by the Chrysler Corp. centers in the Chrysler Parts Division at Marysville, Mich., which handles some 107,000 parts numbers. Master parts depots are maintained at Philadelphia and Chicago, while other depots supply parts

The Post Office Requests

—that you include your *Postal Zone Number* in the signature of all your advertisements, if you are in a city or town that has been zoned.

This will help speed delivery of inquiries addressed to you from the readers of—

AUTOMOTIVE and AVIATION INDUSTRIES

A CHILTON Publication

Chestnut & 56th Sts. Philadelphia 39, Pa.

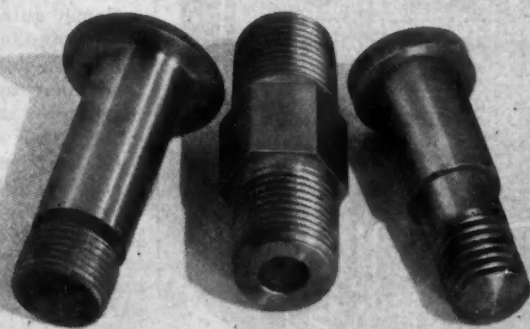


You can accurately measure applied torque in *inch ounces, inch pounds* or *foot pounds*, with STURTEVANT Torque Wrenches as they are built in all capacities from 0-40 inch ounces up to 600 foot pounds or 7200 inch pounds. Over 100 models and types.

Each is a permanently accurate tool.

Write for Bulletin TW-6

*Permanently
Accurate*
TORQUE WRENCH



SPECIAL BOLTS AND STUDS

Uniform in strength, with precise, clean cut threads, and forged heads of any type or shape, RITCO Special Bolts and Studs can be made in any metal . . . ground or unground . . . in sizes up to 2" diameter. We are regularly supplying special bolts to fill the needs of the aircraft, marine, automotive and many other industries.

Remember RITCO for

**SPECIAL BOLTS, NUTS & STUDS
DROP FORGING & DIE SINKING
SCREW MACHINE PRODUCTS
HEAT TREATING
SPRAYED METAL SERVICE
PARKERIZING**

*Estimates gladly submitted. Send samples or blueprints.
Catalog on Request.*

RHODE ISLAND TOOL COMPANY

148 West River St., Providence, Rhode Island

Serving American Industry Since 1834





skill counts

Much of the work at Mercury is the making of assemblies on which others have failed . . . because Mercury's 24 years of aircraft manufacture has developed the technical skill which can come only from long experience.

speed, too

Speed in tooling, in manufacture and in maintaining stiff delivery schedules is not just a matter of machines and man-hours. Here too, skill counts . . . efficient methods, effective supervision and precision production which meets every requirement, come only from skill based on experience.

aluminum fuel and oil tanks • ailerons, fins, rudders and similar surfaces • aircraft parts and accessories.

AT *The Cradle of Aviation*



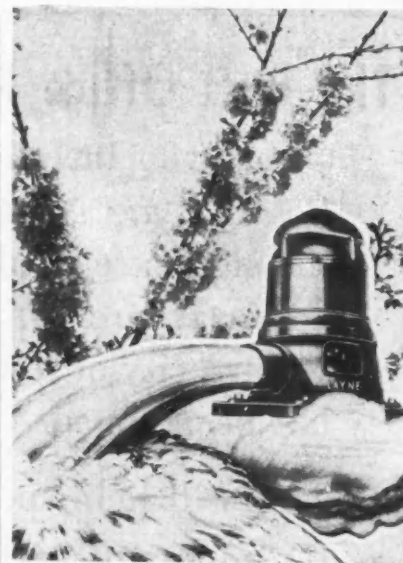
from Kansas City, Atlanta and San Leandro, Cal. General Motors has 55 parts warehouses throughout the country handling parts for all passenger car lines except Cadillac, which functions under its own distributor setup.

Some automotive wholesalers view with apprehension the possibility that the automobile manufacturers may extend their operations in the postwar market by more aggressive tactics in going after direct consumer business. Fear is expressed that some car manufacturers will take over or absorb independent companies now distributing their branded goods through jobbers, thus setting up other outlets for the branded goods. It also is feared that parts manufacturers supplying the automobile factories will be prevailed upon to distribute their branded products, heretofore marketed exclusively through jobbers, through the automobile factory distribution system as well. Establishment of their own jobbing outlets in selected areas by automobile manufacturers and entry into the jobbing field of automobile distributors are other portents viewed with alarm by automotive wholesalers. But so far there is no definite indication that these fears will be translated into actuality.

One automobile company parts executive broached the possibility that small manufacturers who have had war plants financed for them through Government funds may enter the replacement parts business after the war. They will have plant facilities and equipment and trained manpower available so the postwar parts market may look like an attractive field to many such small companies. Their big problem will be adequate distribution for their product. They will have to find sales outlets before they can be assured of any substantial production. However, low costs may be a factor in their favor.

A survey by the Automotive & Aviation Parts Manufacturers, Inc., revealed that 90 per cent of the 204 reporting plants ranked automotive work as their most important field of endeavor after the war, while only 4 per cent failed to name the automotive business in their postwar plans. This would indicate the degree of importance attached to automobile parts manufacturing after the war.

Air cargo transportation is regarded by one parts official of a major automobile manufacturer as a medium that will increase in importance when peace comes, especially with the impetus that it has been given by wartime conditions. He believes that the rapidity and frequency of postwar air express will enable the automobile manufacturers and dealers to cut down their parts inventories, especially on slow moving items. Factory parts warehouses in the field will not have to carry such a complete stock when the dealer can be supplied within 24 hours by air from the main parts warehouse at



IT'S ALWAYS FAIR WEATHER For a Layne Water System

It's always Fair Weather for America's most skilfully designed, sturdily built and thoroughly proven Water Supply System. Sixty-two years of world-wide leadership in well and pump construction are today paying extra dividends in outstanding performance.

Layne, as a pioneer in water development service, has encountered—and solved, perhaps a hundred times more problems than was ever faced by their nearest competitor.

For postwar days, many new well water systems will be needed. They must possess three important features: long life construction, high volume production, and economical operation. Layne Water Systems have always been outstanding in those very attributes.

Layne is now offering engineering guidance on postwar Water System construction plans. This service is obtainable without obligation. Now is the time to present your water supply problems. Literature on Layne Wells and Pumps may be obtained by addressing LAYNE & BOWLER, INC., General Offices, Memphis 8, Tennessee.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Western Co. of Minnesota, Minneapolis, Minn. • International Water Supply Ltd., London, Ontario, Canada



WELL WATER SYSTEMS DEEP WELL PUMPS

**BUILDERS OF WELL WATER SYSTEMS
FOR INDUSTRIES AND MUNICIPALITIES**

25 YEARS OF SERVICE



Since 1919 in the oil fields of the world the significance of the Guiberson trade mark has been proved by the saving of millions of dollars in time, in equipment and in increased recovery of oil.

In the tanks of our armored forces it has been proved by the hard-hitting dependable performance of the Guiberson radial diesel engine.

On the skyways of the world it is being proved day after day by the reliability and service of flap track supports, fire walls, motor mounts, manifolds and hundreds of other Guiberson built aircraft parts that are embodied in America's fighters and bombers.

With hydraulic presses, drop hammers, precision machine tools and the south's finest heat-treating facilities Guiberson are meeting the most exacting engineering and manufacturing standards of the world.

After 25 years "Better Be Safe Than Sorry" is today the criterion of precision-built equipment produced in one of America's finest plants.

And when victory is won the Guiberson "G" will carry forward the precision production of products wrought from the metals of the world



ESTABLISHED 1919

THE GUIBERSON
CORPORATION

GUIBERSON DIESEL
ENGINE COMPANY

Dallas, Texas

FOR EXPERT STEERING ENGINEERING
Include SUPERIOR UNIVERSAL
HEAVY-DUTY STEERING CONNECTIONS
in Your Reconversion Plans

**DRAG
LINKS
•
TIE
RODS
•
RADIUS
RODS**



Superior Universal Heavy Duty Steering Connections are known and used among leading manufacturers throughout the automotive industry. These action-tested parts, with patented take-up feature at *all* connecting points, compensate *automatically* for wear while in service; thus minimize lost motion and resulting driver fatigue, provide safer, more efficient, and more dependable steering.

INVESTIGATE THESE ADVANTAGES

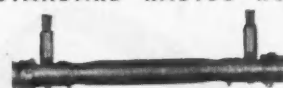
- **EXCLUSIVE** automatic take-up feature on drag links and radius rods.
- Specialized, practical experience in applying steering geometry.
- Twenty years of proved performance in automotive field.
- Expert engineering and manufacturing service on special hydraulic steering systems.
- Complete facilities for **PROMPT SERVICE** when material restrictions are lifted.

Write Today for Informative Bulletins — Sent Without Obligation

SUPERIOR UNIVERSAL PRODUCTS

DIVISION OF SUPERIOR COACH CORPORATION • LIMA, OHIO

STANDARD RADIUS ROD



Patented automatic take-up and lock-cap construction. 3 sizes: 1 1/4", 1 1/2", and 1 3/4" ball size; any length; ball openings for any installation.

**STANDARD TIE ROD
or CROSS TUBE ASSEMBLY**



Automatic adjustable ends to compensate for wear and eliminate lost motion in steering. 3 sizes: 1", 1 1/4", and 1 1/2" ball; all lengths.

SPECIAL DRAG LINK



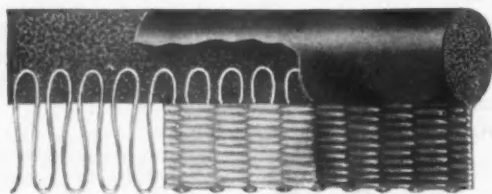
Standard link, standard tie rod end. Used where link is unusually short, causing high angular movement at vertical ball. 2 sizes: 1 1/4" and 1 1/2".

STANDARD DRAG LINK



In standard construction or with take-up feature. 6 sizes: 1", 1 1/8", 1 1/4", 1 1/2", 1 3/4" and 2", in any length up to 76"; any installation.

INNER-SEAL



Established 1837

BRIDGEPORT FABRICS, INC.
 BRIDGEPORT CONN.

UPHOLSTERY CLOTH • NARROW FABRICS • ELASTIC WEBBING

**WATERPROOF
WEATHER
STRIPPING**
 FOR
**PASSENGER
COMFORT**

We also supply fire-resistant seat covering—quality upholstery—for transport planes.



the factory. Of course, lower rates for air express will increase the use of this means of transportation. Door to door delivery of complete cargo plane loads of parts also should prove a factor in increasing use of air freight by the automobile industry. Before the war a crankshaft for a broken down oil truck was delivered from a parts warehouse in Philadelphia to Oklahoma City in 22 hours via air express. The immediate need for the part offset any added cost. Chrysler Corp. initiated air express in the U. S. by shipment of some replacement parts from Detroit in August, 1932. Even before that, back in 1927 and 1928, Ford operated its own tri-motor all-metal transport planes for inter-plant freight and parts shipments between Detroit, Chicago and other Ford branches.

Improvement of railroad freight shipments after the war also is anticipated, which will obviate the necessity for building up such large parts stocks in the field. Thirty-nine-hour freight service between Chicago and Los Angeles, almost as fast as the passenger streamliners, is a possibility that may influence postwar parts distribution policies. Improved over-the-road freight shipments by truck also are in prospect, especially with expansion of limited access express highways like the Pennsylvania Turnpike and the 33,920-mile inter-regional system proposed to Congress by the commissioner

of public roads as a postwar project. That high speed, long distance truck operation at low cost is feasible was indicated recently when a shipment of airframe parts was made from Detroit

to San Diego, Cal., in four days and five hours by a tractor-trailer combination. Truck freight shipments have the flexibility that particularly lends itself to repair parts distribution.

Endurance Tests Prove Quality of Gang-Riveted Joints

(Continued from page 43)

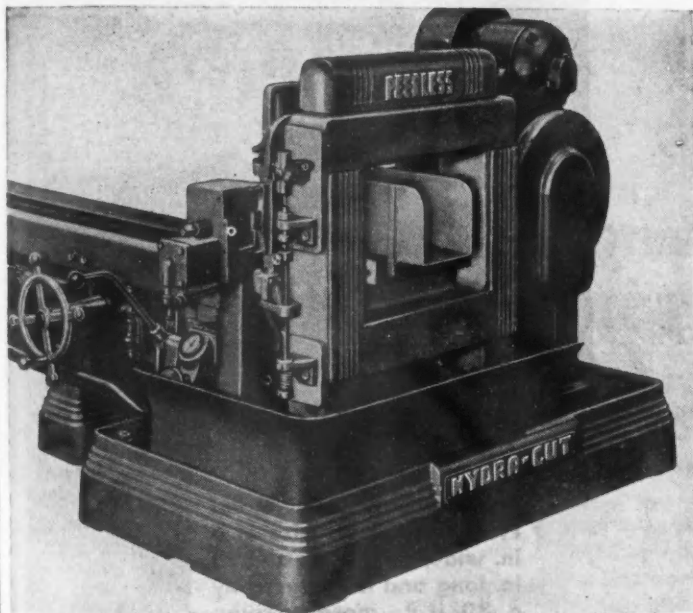
ends of the specimens. These assemblies were vibrated with an amplitude of 1/32 in. at 1700 cycles per minute for a period of 55 hr. The amplitude then was increased to 1/16 in., and vibration was continued until failure occurred. The vibrated rivets were sectioned, mounted, and polished, and macro-photographs were made of rivets headed by the different methods (Fig. 2). The results are tabulated below. The enlarged sectional photographs in no case showed any tendency of the rivet heads to crack under vibration, or due to flattening in the gang riveter.

Sample	Total Hrs. Vibration	Failure and Remarks
Hand riveted	91 1/4	Alclad failed No loosening of rivet
Gang riveted		No loosening of rivet
Paper backed	90	Alclad failed

Sample	Total Hrs. Vibration	Failure and Remarks
Gang riveted No backing	78	Alclad failed No loosening of rivet

The vibration tests did not indicate any difference between the results of the three riveting methods, as the rivets did not loosen in any case. If there had been any inherent weakness in any of the rivet heads due to the method of upsetting, the vibration would have extended it and caused loosening or failure. The conclusion therefore is warranted that rivets set by any of the three methods can be used in production.

**Invest in the
American Way—
BUY WAR BONDS**



CONVERTIBLE . . . for single or multiple bar, automatic cutting

In the field, the Peerless Hydra-Cut is convertible for single or multiple bar, automatic cutting by adding a self-contained conveyor and length gauge. This feature alone offers many practical advantages on clean up war contracts and is worthy of the most thorough checking by your postwar planner. The new Peerless Hydra-Cut gives you substantial increases in cutting speed, sustained accuracy, longer blade life and cooler operation. All have the Four-Sided Saw-Frame that is distortion-proof and distinctly an advantage offered *only* by Peerless. Send for *all* the facts about the new Peerless Hydra-Cut.

PEERLESS MACHINE COMPANY
1600 JUNCTION AVE. • RACINE, WISCONSIN

*Builders of Fine Tools for Thirty Years—Acro-Matic Grinders
Hydraulic Pumps . . . Blades . . . Coolant . . . Special Machinery*

PEERLESS

Metal Cutting Saws

FAST ACCURATE CUTTING DEMANDS PEERLESS BLADE CONTROL

PEERLESS MACHINE CO., Dept. AA-444, Racine, Wis.
☐ Mail Catalog on Hydra-Cut Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company _____

Individual _____

Street _____

City _____

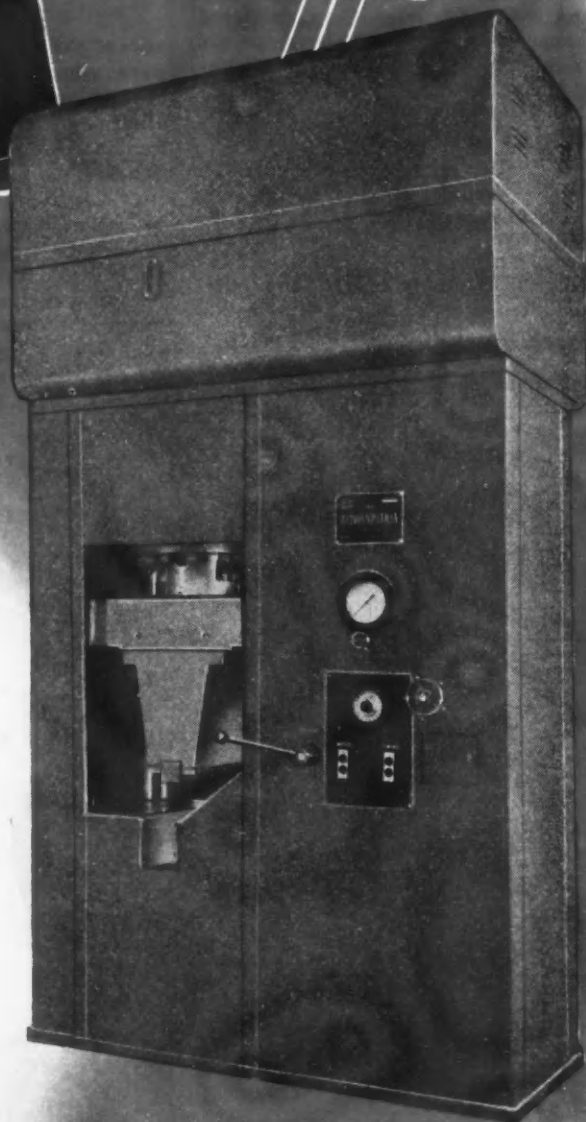
State _____

POWDERED METAL PARTS PRESSED

Uniformly

This Watson-Stillman 400-ton Press is designed to assure a high degree of accuracy and consistently uniform structure density in compressed powdered metal parts. Smooth, pulsationless pressure application, accurate stepless pressure adjustment, automatic cycle controls after being set for production runs, assure continuous performance and exact duplication.

Perhaps your powdered metal molding operations can be simplified and costs reduced by using this new Watson-Stillman press. Additional details will gladly be furnished on request. Write to the Watson-Stillman Company, Roselle, New Jersey.

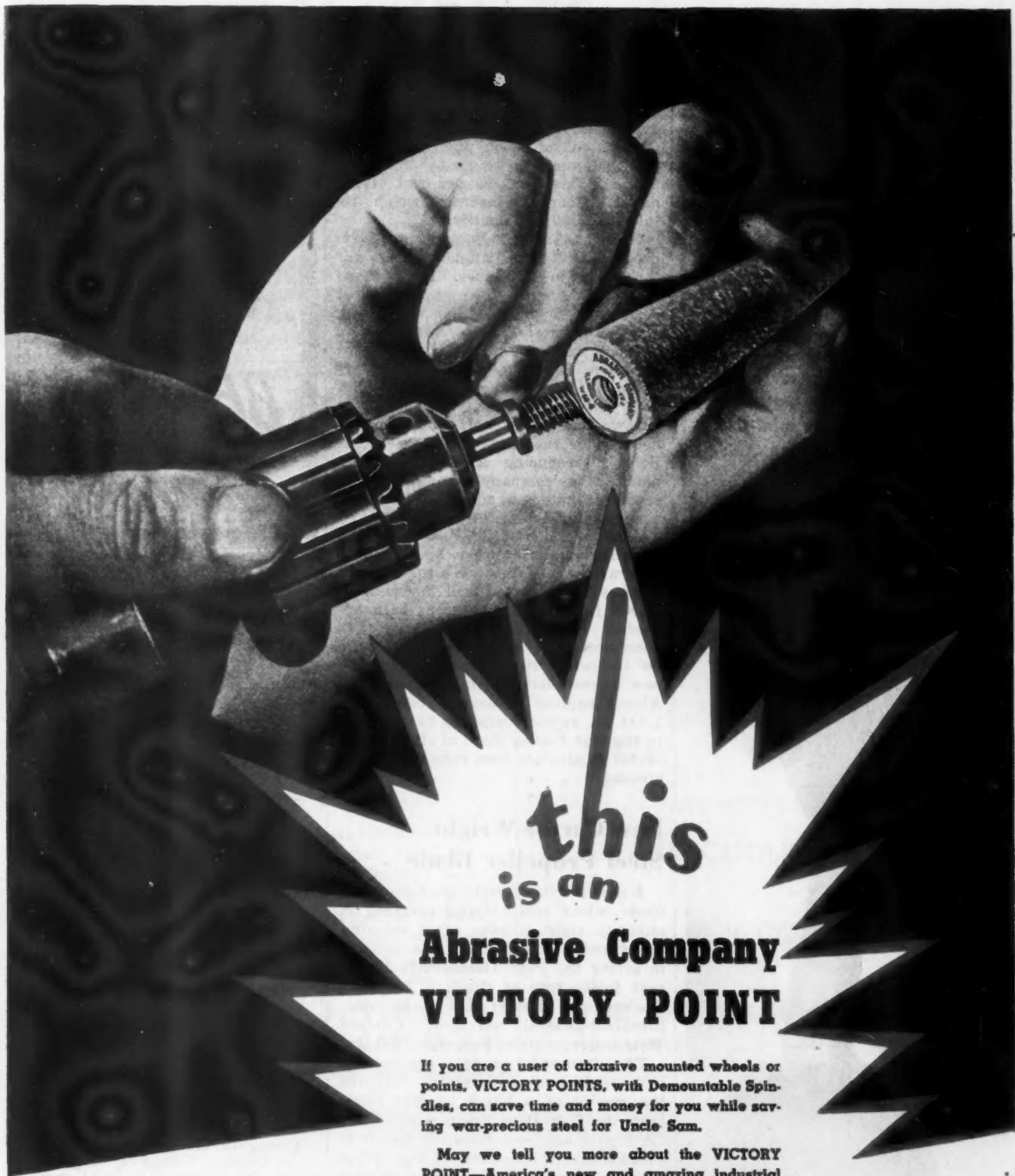


This new Powdered Metal Press has a mold size of 6 in. wide, 7 in. deep and 30 in. long and is powered by a 30 H.P. motor driven radial piston pump.

WATSON-STILLMAN

—DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, FORGED STEEL FITTINGS, AND VALVES—

Ⓜ 5243



this
is an

Abrasive Company VICTORY POINT

If you are a user of abrasive mounted wheels or points, VICTORY POINTS, with Dismountable Spindles, can save time and money for you while saving war-precious steel for Uncle Sam.

May we tell you more about the VICTORY POINT—America's new and amazing industrial tool? Just write on your letterhead for FREE Catalog. Please ask for Form ESA-67.



COMMANDING QUALITY . . . OUTSTANDING RESULTS

ABRASIVE COMPANY

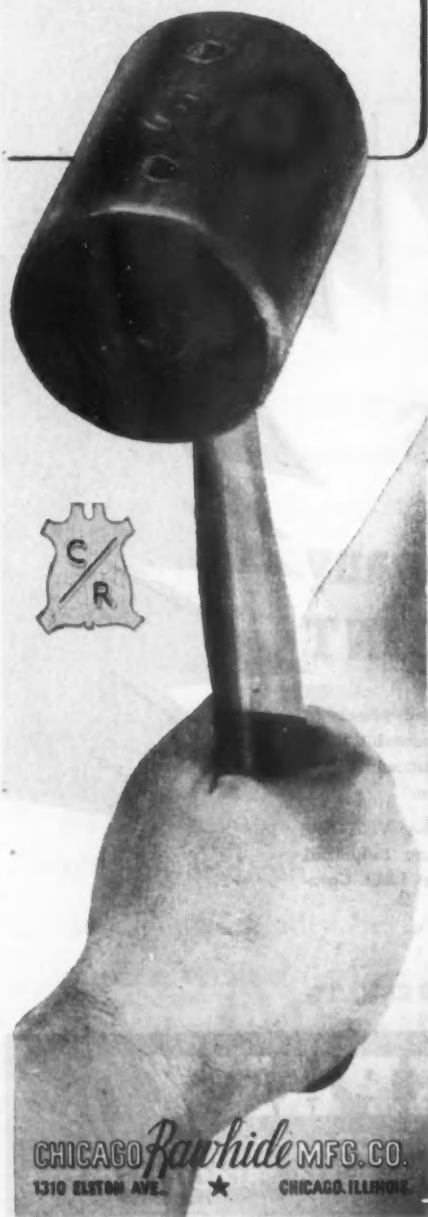
DIVISION OF SIMONDS SAW AND STEEL CO.

TACONY & FRALEY STS., PHILADELPHIA, PA. • DISTRIBUTORS IN ALL PRINCIPAL CITIES

Rawhide

The best "soft" hammers and mallets are rawhide—tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

Write for Catalog Sheets.



Aircraft Production Notes

Twenty-nine per cent of the nation's February production total of 8,760 planes came from Pacific Coast plants, according to the Aircraft War Production Council, Inc. February's West Coast total of 2,569 planes, 10 more than January, weighed 32,469,000 pounds, which was 35 per cent of the nation's February airframe weight total or 93,500,000 pounds.

Gruman Aircraft Engineering Corp. produced 450 Hellcat fighter planes for the Navy in December. Since Pearl Harbor Gruman has manufactured 6,249 planes of all types, including Wildcat fighters and Avenger dive bombers as well as Hellcats. Niagara Frontier Division of Bell Aircraft Corp. is tapering off production of P-39 Airacobra planes to concentrate on two new models. It has been announced by the Army Air Forces that Bell is producing a jet propulsion plane. The company's annual report revealed that Bell also has developed a successful helicopter.

A new version of the P-38 Lightning is being manufactured by Lockheed Aircraft Corp. The P-38's service ceiling has been boosted well in excess of 40,000 ft. and its range has been extended. A 30 per cent increase in horsepower has been achieved through an improved turbo-supercharger and new inter-coolers which enable the two Allison engines to develop more than 1,500 hp. apiece compared to 1,150-hp. in the first P-38's. Rate of climb above 30,000 ft. also has been considerably increased.

New Curtiss-Wright Steel Propeller Blade

A new Curtiss-Wright steel propeller blade, which was shipped overseas in quantity eight months after entering the drawing board stage, has assisted in giving the P-47 Thunderbolt 30 per cent faster rate of climb, it has been disclosed by Robert L. Earle, vice-president-general manager, Curtiss-Wright Corporation, Propeller Division.

The disclosure of this engineering and production achievement followed the receipt of a letter by Mr. Earle from the War Department which said: "A report has been received that it is the consolidated opinion of our pilots that due to wide-bladed propellers, and other improvements, the P-47's now have a rate of climb which is generally superior to German fighter planes."

The new hollow steel blade was designed, developed, accepted in Army tests, produced in quantity and flown in combat within an eight months' period. With the new, wider Curtiss-Wright hollow steel blades to take advantage of increased engine horsepower, the Thunderbolts can now generally outclimb the best German fighter airplane while still retaining the already existent edge in top speed.



Blinking and flickering of dying fluorescent lamps not only annoy busy war workers but cause ballasts to overheat and sometimes fail. That's serious. Then your maintenance man has a costly and time-consuming job on his hands.

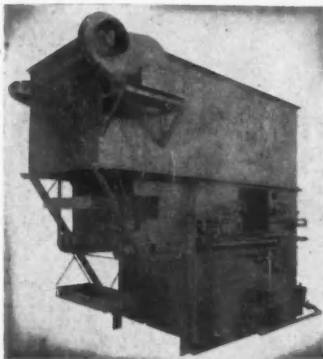
You can cut lighting maintenance to a minimum by installing G-E Watch Dog Fluorescent Starters — FS-40 for 40-watt lamps and FS-100 for 100-watt lamps. The Watch Dog eliminates annoying blink and flickering automatically and positively by cutting itself out of the circuit. Replacements are fewer because the Watch Dog lasts considerably longer than ordinary starters. Under specified test conditions, the FS-40 outlasts an average of ten 40-watt lamps. And most important of all, the Watch Dog safeguards against hot ballasts by preventing dying lamps from being started needlessly. All this adds up to less major repairs when manpower is critical.

Our new catalog tells how to use fluorescent accessories for best lighting results. You can obtain your free copy by writing to Section G441-103, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

Hear the General Electric radio programs: "The G-E All Girl Orchestra," Sunday 10:00 P.M. EWT, NBC. "The World Today," news every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS

GENERAL ELECTRIC



BLAKESLEE IS THE NAME!

Blakeslee single end automatic vapor spray type degreaser for cleaning metal parts such as fuse bodies, boosters, etc., where the parts are heavily coated with oil and chips.

Blakeslee is the pioneer name in parts washing and degreasing machines and equipment that you hear everywhere today in aviation and automotive production . . . Blakeslee is the name that means top speed in removing oil, chips and drawing compound from all metal parts and therefore means speed in finishing, machining and inspection operations . . . Blakeslee is the name of world famous *engineered-for-you* washing and degreasing machines. Consult Blakeslee engineers now, *today*, without obligation and get their answer to your washing and degreasing problems. Complete descriptive literature furnished upon request.

G. S. BLAKESLEE & CO. MAIN OFFICE & WORKS • CICERO STATION **CHICAGO** NEW YORK • TORONTO

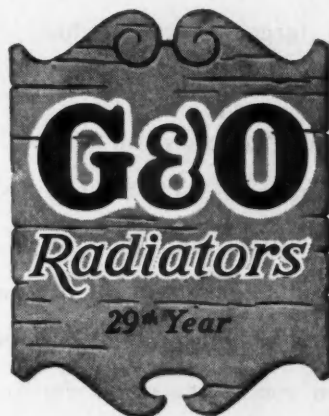
ORTHO-HELIX CONTROLLED DIRECTION OF FORCE SPRINGS



● ORTHO-Helix Springs have set new standards of excellence in accurately controlling the direction of force. Ortho-Helix Springs seat valves evenly and eliminate uneven wear on valve guides and valve stems. A demonstration test with a Helixometer will prove their extra value.

Your inquiry is invited.

American Coil Spring Co.
MUSKEGON, MICHIGAN



AUTOMOTIVE and AVIATION

ENGINE COOLING RADIATORS

OIL COOLERS

THE G&O MANUFACTURING CO.
NEW HAVEN CONNECTICUT

FOR

**CLEAR,
SHARP MARKING**

USE..



220 E. CARSON ST., PITTSBURGH, PA.

A WASTEFUL BROADSIDE *from your company*

CAN CRIMP A NAVY BROADSIDE

Against the Japs

YOU BET IT CAN. For the ammunition which our fleet fires reaches its destination protected by paper. And the paper you waste in an ornate, unnecessarily large advertising broadside is just what the Navy and the Army need to do their job. That's why Uncle Sam asks you to watch every company project in terms of **USING LESS PAPER**. Whether it's a direct mail piece or a letter or a paper-board container—think of it as a challenge to you and to your colleagues. Yes, a challenge to you to see how you can carry on your business and

at the same time cut down and cut down and cut down on your company's use of paper.

Remember the whole country is being enlisted in this drive. You'll be a soldier in a mighty army of paper conservers.

And remember, right now, there's no home-front conservation job any more urgent or important than the conservation of paper and paper board.

If your company or your community has not yet organized Paper Conservation Committees, why not start them yourself and now?

Use Less Paper Because

Each 500-pound bomb takes 12 pounds of paper for rings, tops and bottoms.

A fiber container for a 75-millimeter shell takes 1.8 pounds of paper board.

Each weapon part must be wrapped in grease-proof paper and in waterproof paper. A single shipping case of decontaminating apparatus requires 273 square feet of waterproof lining paper.

All kinds of paper are used by the Army, from vegetable parchment, .0015 inches thick, to heavy paper board and wallboard.

Use Less Paper These Ways

Use smaller type sizes and margins. (Any competent printer, in consultation, can point the way to pronounced savings by these means.)

Reduce separators to shoulder height.

Eliminate top and/or bottom pads in every practical instance.

Make scratch pads from stocks of obsolete letterheads, memorandum forms, and other unused inventory.

Cut the weight of paper stocks. (You tell the printer how long you expect a record to endure and he can tell you what stock to order.)

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER



PLUG IN ANYWHERE ALONG THE LINE — WITH BULLDOG BUS DISTRIBUTION DUCT

This photo shows Bulldog Bus Duct used on welder circuits. Note the short cable runs from overhead Plugs.

When you install Bus Duct, you wipe out a great many of your electrical power problems.

You can add new machines at will or move old ones to any location because ten plug-in openings are available in each standard 10-foot section of safely-enclosed duct casing.

This gives your workers a constant flexible source of power that is safe . . . convenient . . . clean . . . efficient.

Also, Bus Duct can be easily and quickly installed. Any plant electrician with a couple of helpers can put it up. And it is 100% salvable.

Those plants which have Bus Duct will be a long step ahead in reconverting to peace production. Our field engineers will be happy to help you with *your* power problems. Write today for complete descriptive Bulletin No. 427.

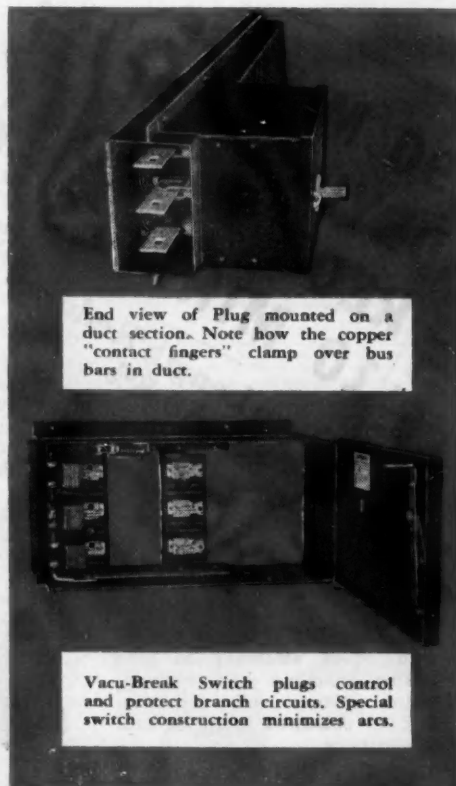
BULLDOG ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
Bulldog Electric Products of
Canada, Ltd., Toronto, Ont.



Field Engineering Offices in All Principal Cities

Buy More War Bonds
Get In Your Scrap



End view of Plug mounted on a duct section. Note how the copper "contact fingers" clamp over bus bars in duct.

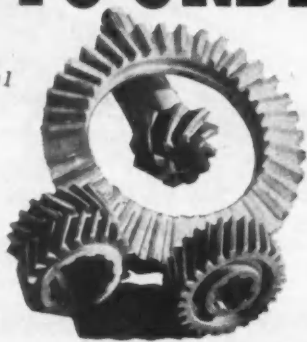
Vacu-Break Switch plugs control and protect branch circuits. Special switch construction minimizes arcs.

ALSO MANUFACTURERS OF

VACU-BREAK SAFETY SWITCHES • SAFTOFUSE PANELBOARDS • SWITCHBOARDS •
CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT, for flexible lighting •
INDUSTRIAL TROL-E-DUCT, for movable "loads."

MADE TO ORDER

straight bevel
differentials
spiral bevel
herringbone
helical
hypoid
worm
spur



GEARS

Behind Fairfield's Gears is a multiple assurance of the accuracy universally demanded of gears. Fairfield has been making fine gears for more than 25 years—for leading manufacturers of industrial, agricultural and transportation equipment. Modern and complete facilities for processing and testing gears characterize the Fairfield plant. Technical skill marks the engineers and craftsmen. By familiarizing yourself with Fairfield's gear making and engineering services you will learn of the advantages offered.

FAIRFIELD MANUFACTURING CO.
319 S. Earl Avenue Lafayette, Ind.



FAIRFIELD

for FINE
GEARS

90 MINUTE
DRYING TIME
REDUCED TO
10 MINUTES

d
ey
pod
ibes.
-ussia
e Japs
These
s Japs
them
ght-
japs

Oven Length Reduced
58.8%

to p- h
are hi
count
Fat
for gra
on i
bases
as w
an i
ing
Fa
mad
brea
by
aga
resu
wel
cap
C

Get the Facts!

This "Infra-Red" Principle applies with equal efficiency to food baking, roasting and cooking; metal melting and annealing and an unlimited range of heat applications.



BURDETT "INFRA-RED" GAS BURNER
(The Original)

17 NORTH LOOMIS ST., CHICAGO 7, ILL.



BURDETT MANUFACTURING CO.
Infra-Red Gas Burners



AUTOMOTIVE and Aviation INDUSTRIES

is read by general executives, production men, engineers, purchasing agents and others whose o.k. means orders for those who sell to The World's Largest Manufacturing Industry.

Aero-Seal HOSE CLAMPS

Distinctive worm gear tightening action provides powerful belt-like pull-up. Uniform pressure all around prevents leaks. Can be put on or taken off hose in place on pipe. Can be re-used. No loose parts. Compact design. Extremely long take-up. Made in sizes from 1/2" up. Write for circular.

Aircraft Standard Parts Co.
1717 D NINETEENTH AVE., ROCKFORD, ILL.

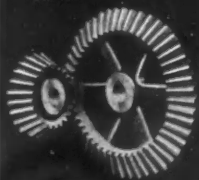
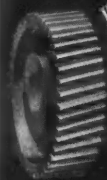
Specify

MECHANICS
Roller Bearing
UNIVERSAL JOINTS



SHAFT ASSEMBLIES
MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp., 2026 Harrison Ave., ROCKFORD, ILL.

MAKE THE NAME - "Industrial" YOUR STANDARD



for CUT GEARS
CUT RACKS
CUT SPROCKETS

We have the facilities, the equipment, the personnel and the "know-how" to give you the kind of service and cooperation you need for cut gears of any type, in any quantity—any material.

We also produce sprockets for Roller and Silent Chains and do precision surface grinding. Latest modern equipment.

Let us have your next order, or visit our plant when in Chicago.

The Plant that Quality and Service Built
CHICAGO'S FASTEST GROWING GEAR PLANT



INDUSTRIAL GEAR MFG. CO.

4518 VAN BUREN STREET CHICAGO 24, ILLINOIS

Controlled Rubber



All Types of Extruded and Molded Rubber Products Manufactured to Your Specifications.

A wide variety of stocks available... facilities for quantity production in a completely new, modern plant.



Los Angeles
STANDARD
Rubber, Inc.

1500 EAST GAGE AVENUE • LOS ANGELES 1, CALIFORNIA

TUNGSTEN

..the gold reserve of industry



... enables contacts to go on the "three-shift" standard

Tungsten in electrical contacts adds the essential impetus to the tools. It reduces service interruptions caused by excessive oxidation and pitting. Replacements, through surface resistance, are minimized.

METROLOY tungsten contacts are designed for severe, hard service; extensive use in vital ordnance work proves their ability to "carry on" for consumer needs later.

Metroloy Company, 55-57 E. Alpine St., Newark, N. J.

METROLOY
TUNGSTEN PRODUCTS



NEAREST TO RESISTANCE-FREE OPERATION

These exclusive features give MOTOR TOOL LIVE CENTERS EXTRA LONG LIFE

In addition to standard more taper sizes (1 to 7, inclusive) carried in stock...

Precision-built MOTOR TOOL LIVE CENTERS are constantly being developed by our engineering staff for numerous SPECIAL machining operations. Spindles, heads, tapers and points are designed to exactly fit the work to be done. Whatever your needs—standard or SPECIAL—consult with our engineers. Know the speedier production and greater economy of using MOTOR TOOL LIVE CENTERS—the centers that will not burn out or break down no matter how long or how tough the job.

LOOK FOR REDRESSING POINT WITHOUT DISASSEMBLING

NEEDLE BEARING FOR TRUE RUNNING AND PREVENTION OF CHATTER

CORR. THRUST PAD COMPENSATOR FOR HEAT AND EXPANSION OF WORK

HEAVY DUTY BALL BEARING FOR GREATER THRUST LOAD

HEAVY DUTY ROLLER BEARING FOR GREATER RADIAL LOAD CAPACITY

GREASE SEAL TO RETAIN LUBRICANT AND KEEP OUT FOREIGN MATTER

LARGE SPINDLE FOR STURDINESS AND GREATER LOAD



MOTOR TOOL MANUFACTURING CO.
METAL CUTTING TOOLS

7775 CORTLAND AVENUE • DETROIT 4, MICHIGAN

Make it a Rule to Call Motor Tool

B-H MANUFACTURERS OF SHEET METAL
AND TUBULAR ACCESSORIES



CONTRACTORS TO ALL LEADING
ENGINE AND PROPELLER
MANUFACTURERS

**TUBULAR
PARTS**

B-H AIRCRAFT CO., Inc. LONG ISLAND CITY 1,
NEW YORK

**TOOLS—DIES—JIGS—FIXTURES
PRODUCTION JOB WORK—STAMPINGS**

We are equipped to render complete
service from design to production.


ROCKFORD DIE & TOOL WORKS, INC.
1816 Seventeenth Ave. Rockford, Illinois Phone Main 3084

LEADING THE
INDUSTRY IN
CARBIDE TOOLS
SINCE 1930

**Vascoloy
RAMET**

**TANTUNG
CUTTING TOOLS
—
DIES** 439

VASCOLOY RAMET CORP. • NORTH CHICAGO, ILLINOIS

 **STOP LOSSES** MAKING DIES & TEMPLATES
... WITH **DYKEM**
STEEL BLUE

Simply brush on right at bench:
ready for layout in few minutes.
Dark blue background makes
scribed layout lines show up in
sharp relief. Also prevents metal
glare, increasing efficiency and ac-
curacy. Write for details!
The DYKEM CO., 2301 L.N. 11th St., St. Louis, Mo.
In Canada: 444 Pacific Ave., Toronto, Ont.

STAMPINGS

Heavy, medium and light stamp-
ings in any quantity. A steady flow
of production—when you want it.

WORCESTER STAMPED METAL CO.
9 Hunt Street, Worcester, Mass.

QUALITY STAMPINGS

**ELECTRIC
FURNACES**

FURNACES
Gas Fired, Oil Fired or Electric
For any Product, Process or Production
Send your inquiries direct to
The Electric Furnace Co.
Salem, Ohio

VICTOR

Where
Secure
Seals Are
Vital

**GASKETS
OIL SEALS
GREASE RETAINERS**



LITTELL ROLL FEEDS
and REELS

FOR FASTER SPEEDS
Littell makes a complete
line of Automatic Feeds,
Reels, Straighteners, etc.
Request Bulletin.

F. J. LITTELL MACHINE CO. 4155 RAVENSWOOD AVE.
CHICAGO, ILL.



Gabriel HYDRAULIC
SHOCK ABSORBERS

Established 1904 The GABRIEL Co., Cleveland 14, Ohio



AETNA PRODUCTS

Include Thrust (standard and special) and Angular Con-
tact Ball Bearings, Roller Bearings (special), Ball Retain-
ers and Hardened and Ground Washers.

AETNA BALL BEARING MANUFACTURING COMPANY
4600 SCHUBERT AVENUE — CHICAGO, ILLINOIS

DETREX SOLVENT DEGREASING
and ALKALI CLEANING

All Types of Metal Cleaning Equipment
and Cleaning Chemicals • Processing Machines

DETREX CORPORATION
13001 Hillview Ave. • Detroit 27, Michigan



**AUTOMOTIVE and Aviation
INDUSTRIES**

Penetrates into Leading Plants
in the
Automotive and Aircraft Industries

Classified Advertisements

AUTO MECHANICS: PROVEN NEW ONE-MINUTE METHOD
TO REMOVE ALUMINUM HEAD FROM FORD MOTORS WITH-
OUT TOOLS. FULL INSTRUCTIONS, \$1.00. WALTHAM TIRE
EXCHANGE, 614 MOODY STREET, WALTHAM, MASS.

AUTOMOTIVE LINES WANTED
MANUFACTURERS REPRESENTATIVE, DRAFT EXEMPT,
OVER 12 YEARS' SELLING EXPERIENCE, COVERING AUTO-
MOTIVE, ELECTRICAL, AND PARTS JOBBERS IN WESTERN
PENNA., W. VA., KENTUCKY, OHIO, INDIANA AND MICHIGAN,
CAN HANDLE ADDITIONAL LINES. BOX 100, CHIL-
TON CO., CHESTNUT & 56th STS., PHILADELPHIA 39, PA.

A MANUFACTURING AND SALES EXECUTIVE aged 50 with
over 20 years sales experience with Detroit industry, desires to
represent an established and reputable concern in the Detroit
area. Address Box 97, Chilton Co., 56th & Chestnut Sts., Phila-
delphia 39, Pa.

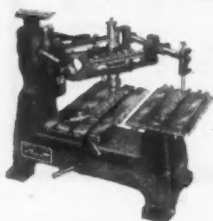
FELT

Only first rate FELTS, meeting required specifications and tests, will function properly. Substitutes will not do. Check this with your engineers . . . then buy FELT with confidence.

American Felt Company

General Offices:  GLENVILLE, CONN.

New York Boston Chicago Detroit Philadelphia St. Louis
Cleveland Los Angeles San Francisco Dallas Seattle



Now . . .
**A Heavy-duty
Bench-type Engraving
and Marking Machine . . .
The PANTO Model UE-3**

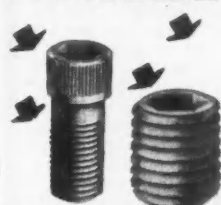
- HEAVIER CUTTING SPINDLE
- MORE PANTOGRAPH REDUCTIONS
- FOUR SPINDLE SPEEDS
- FORMING GUIDE ATTACHMENT

Plus the exclusive Panto feature . . . Interchangeable heads for engraving, electrical marking, and acid etching.

» Write for new Catalog

H. P. PREIS ENGRAVING MACHINE COMPANY
157C Summit Street Newark, New Jersey

DANLY *Knurled*



All Die Makers' Supplies
Danly Commercial Sets
Danly Special Sets

**SOCKET-HEAD CAP SCREWS
HOLLOW SET SCREWS**

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue, Chicago, Illinois
MILWAUKEE • LONG ISLAND CITY, N. Y.
DAYTON • DETROIT • ROCHESTER
CLEVELAND • PHILADELPHIA
DUCOMMUN METALS & SUPPLY CO.
Los Angeles • San Francisco

DANLY PRECISION DIE SETS



HARDNESS TESTING

The STANDARD SCLEROSCOPE (Now highly improved) for more than twenty years has made good and is still used for doing the world's hard work in testing. In general use for specifications purposes. Simple, Sturdy, Comparatively Inexpensive. Illustrated bulletins free. **FOR QUALITATIVE AND QUANTITATIVE HARDNESS MEASUREMENT,** under Static Pressure, the MONOTRON is the only machine now available. Operative up to over 2000 Diamond Brinell. Avoids errors due to spring in test pieces. Takes readings with the load on, avoiding reversal lash errors. No setting to zero. Operates at highest Speed. Has solved many old laboratory and shop problems. We also make the Durometer for testing the hardness of rubber. Comprehensive bulletins free.

THE SHORE INSTRUMENT & MFG. CO.
Van Wyck Ave. and Carl St., Jamaica, New York, N. Y.
Agents in all Foreign Countries

WITTEK AVIATION HOSE CLAMPS Standard Equipment on NORTH AMERICAN B-25 MITCHELL



Since the beginning of modern aviation Wittek Hose Clamps have been known as the standard of the industry. Today they are being used by the nation's leading military aircraft and engine builders.

WITTEK HOSE CLAMPS

Automotive and Aviation




.. for over 40 years
**THE PIONEER
MANUFACTURER OF**

AUTOMATIC CHUCKING EQUIPMENT

POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, RHODE ISLAND

INVENTORS!

We seek specialized equipment, preferably patented, in Aircraft, Automotive, and Building Trade Fields; also established U.S. products for development and production by the associated companies of the Simmonds Group throughout the world. 

SIMMONDS AEROCESSORIES, INC.

30 Rockefeller Plaza
New York 20,
N. Y.

DIAMONDS for Victory

BIG-HEAD-NIBS LOC-KEY-SET

• Three grades of diamonds. Common quality \$12 per karat. Medium quality \$24 per karat. Select quality \$48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)
All diamond sizes 1/4 to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. (24 hour resetting service, \$1.00 post paid.)
Distributed thru Mill Supply Jobbers.
Write for Free Grinder's Instruction Card and Catalog

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
938 E. 41st Street CHICAGO, ILL.

RE-SET-ABLE
Means more
for your money.
Prolongs the life
of diamond dressers.



AC Spark Plug Div.	—	Buell Manufacturing Co.	—
Abrasive Company	135	Bullard Co., The	122
Abrasive Dressing Tool Co.	119	Bulldog Electric Products Co.	139
Abrasive Machine Tool Co.	—	Bundy Tubing Co.	—
Accurate Spring Mfg. Co.	—	Bunting Brass & Bronze Co.	—
Ace Mfg. Corp.	—	Burdett Manufacturing Co.	140
Acheson Colloids Corp.	—	Burgess-Norton Mfg. Co.	—
Acme Pattern & Tool Co., Inc.	92	—	—
Adel Precision Products Corp.	—	Camloc Fastener Corp.	—
Aero Screw Company	—	Campbell, Andrew C., Div., Amer.	—
Aeroquip Corporation	—	Chain & Cable Co., Inc.	—
Aerosphere, Inc.	—	Campbell, Wyant & Cannon Foundry Co.	118
Aetna Ball Bearing Mfg. Co.	142	Cannon Electric Development Co.	—
Ahlberg Bearing Co.	—	Carbide & Carbon Chemicals Corp.	—
Air-Maze Corp.	—	Carboloy Co., Inc.	—
Air Reduction Sales Co.	108	Cardox Corp.	—
Aircraft Accessories Corp.	—	Carnegie-Illinois Steel Corp.	123
Aircraft & Diesel Equip. Corp.	—	Carpenter Steel Co.	57
Aircraft-Marine Products, Inc.	—	Celanese Celluloid Corp.	90
Aircraft Nut Corp.	124	Central Equipment Co.	117
Aircraft Screw Products	—	Central Screw Co.	91
Aircraft Standard Parts Co.	140	Chace Co., W. M.	62
Ajax Electrothermic Corp.	—	Chamberburg Engineering Co.	—
Allegheny Ludlum Steel Corp.	127	Chandler Products Corp.	91
Allied Products Corp.	85	Cherry Rivet Co.	—
Allison Div., General Motors	—	Chicago Rawhide Mfg. Co.	136
Aluminum Co. of America	—	Chicago Screw Co., The	124
Aluminum Industries, Inc.	—	Cincinnati Milling Machine Co.	16
Alvey-Perguson Co., The	—	Cities Service Oil Co.	—
American Air Filter Co., Inc.	—	Clark Equipment Co.	83-84
American Bosch Corp.	—	Clark Tractor Div. Clark Equip. Co.	—
American Brake Shoe Co.	—	Clayton Mfg. Co.	—
American Brakeblok Div.	—	Clearing Machine Corp.	—
American Broach & Machine Co.	—	Cleveland Pneumatic Tool Co.	—
American Chain & Cable Co., Inc.	113	Climax Molybdenum Co.	—
American Chemical Paint Co.	—	Cold Metal Products Co., The	—
American Coil Spring Co.	137	Columbia Steel Co.	123
American Felt Co.	143	Cone Automatic Machine Co., Inc.	55
American Hammered Piston Ring Div. Koppers Co.	—	Consolidated Vultee Aircraft Corp.	—
American Mach. & Metals, Inc.	58	Continental-Diamond Fibre Co.	104
American Screw Co.	91	Continental Rubber Wks.	—
American Steel & Wire Co.	123	Continental Screw Co.	91
Andover Motors Corp.	—	Corbin Screw Corp., The	91
Arens Controls, Inc.	—	Cotta Transmission Corp.	1
Arkansas Fuel Oil Company	—	Crane Packing Co.	109
Armstrong Cork Co.	—	Cullen-Friestedt Co.	128
Aro Equipment Corp.	—	Cunningham Co., M. E.	137
Arrow Safety Device Co.	—	Curtis Pneumatic Machinery Div. of Curtis Mfg. Co.	—
Arter Grinding Machine Co.	—	Danly Machine Specialties, Inc.	143
Associated Spring Corp.	—	Dardelet Threadlock Corp.	—
Atlas Drop Forge Co.	128	Davis & Thompson Co.	—
Auto Specialties Mfg. Co.	—	Dearborn Gage Co.	—
Automatic Transportation Co.	—	Deepfreeze Div. Motor Products Corp.	—
Automotive & Aircraft Div. Amer. Chain & Cable Co., Inc.	—	Denison Engineering Co., The	49
—	—	Detrex Corp.	142
B-H Aircraft Co.	142	Detroit Broach Co.	—
Bakelite Corp.	13	De Walt Products Corp.	79
Baker Ind. Truck Div. Baker Raulang Co.	—	Diamond Tool Co.	143
Baldwin Southwark Div.	111	Diston & Sons, Inc., Henry	—
Bantam Bearings Div., The Torrington Co.	146	Dole Valve Co., The	70
Barber-Colman Co.	—	Dow Chemical Co.	—
Barnes Co., W. F. & John	—	du Pont de Nemours & Co. (Inc.)	82
Bearings Co. of Amer.	—	Duro Metal Products Co.	—
Bellevue Mfg. Co.	—	Dykem Co., The	142
Bendix Aviation Corporation	—	Dynamic Air Engrg., Inc.	99
Bendix Products Div.	14	—	—
Eclipse Machine Div.	—	Eaton Mfg. Co.	—
Landing Gear Div.	—	Eclipse Machine Division Bendix	—
Stromberg Carburetor Div.	—	Elastic Stop Nut Corp. of America	81
Bendix-Westinghouse Automotive Air Brake Co.	—	Electric Auto-Lite Co.	87
Berg Engineering Service	—	Electric Furnace Co., The	142
Bethlehem Steel Co.	86	Electric Storage Battery Co.	105
Bjfor Lubricating Corp.	60	Electro Metallurgical Co.	—
Birdsboro Steel F'dry & Mach. Co.	—	Electro Products Laboratories	—
Black & Decker Electric Co.	—	Emerson Machinery Corp.	—
Blakeslee & Co., G. S.	137	Emerson Electric Mfg. Co., The	—
Blanchard Machine Co., The	63	Empire Electric Brake Co.	—
Bliss & Laughlin, Inc.	—	Erie Malleable Iron Co.	—
Booth Felt Co., The	—	Evans Reamer & Machine Co.	—
Boots Aircraft Nut Corp.	—	Ex-Cell-O Corp.	11
Borg & Beck Div. Borg-Warner	—	—	—
Borg-Warner Corp.	—	Fairfield Mfg. Co.	140
Bridgeport Fabrics, Inc.	132	Federal-Mogul Corp.	—
Brillion Iron Works, Inc.	—	Federal Press Co., The	—
Bristol Co., The	91	Federal Seal Company	—
Brown-Lipe Gear Co.	61	—	—
Brush Development Co., The	114	—	—
Bryant Chucking Grinder Co.	71	—	—

Felters Co., The	121
Fenn Aircraft Div.	—
Firestone Industrial Products Co.	115
Fischer & Porter Co.	—
Fisher Furnace Co.	—
Fitchburg Grinding Machine Corp.	75
Fitzgerald Mfg. Co., The	—
Foot Bros. Gear & Machine Corp.	10
Formica Insulation Co., The	—
Fostoria Industrial Service	—
Frontier Bronze Corp.	—
Fuller Mfg. Co.	—
Fulton Company, The	—
Fulton Syphon Co., The	—
—	—
G & O Mfg. Co.	131
Gabriel Company	142
Gairing Tool Co., The	—
Galland-Henning Mfg. Co.	—
Gear Grinding Machine Co.	—
General Aniline & Film Corp.	—
General Controls	—
General Electric Co.	136
General Machinery Corp.	94
Gibson Company, Wm. D.	—
Gisholt Machine Co.	8
Gits Bros. Mfg. Co.	—
Globe Steel Tubes Co.	—

Index

The Advertisers' Index is published of the advertising contract. E rectly. No allowance will be m

Govro-Nelson Co., The	—
Grand Specialties Co.	—
Great Lakes Steel Corp.	—
Greenlee Bros. & Co.	—
Grizzly Mfg. Co.	—
Guiberson Diesel Engine Co.	131
—	—
Hall Mfg. Co.	—
Hansen Mfg. Co.	—
Harnischfeger Corp.	12
Harper Co., The H. M.	91
Harrisburg Steel Corp.	106
Harvey Machine Co., Inc.	—
Hayes Industries, Inc.	—
Heald Machine Co., The	—
Herbrand Corp.	—
Hercules Powder Co., Inc.	93
Hills-McCanna Co.	—
Hollingshead Corp., R. M.	—
Holliston Mills, Inc., The	—
Hooven, Owens, Rentschler Co.	94
Hoover Ball & Bearing Co.	—
Houdaille-Hershey Corp.	—
Houghton & Co., E. F.	—
Howell Electric Motors Co.	126
Hyatt Bearings Div. G. M. Corp.	—
Hycar Chemical Co.	—
Hydraulic Machinery, Inc.	—
Hydraulic Press Mfg. Co., The	—
Hydopress, Inc.	—
—	—
Imperial Brass Mfg. Co., The	—
Independent Engineering Co.	—
Indium Corp. of America	—
Industrial Gear Mfg. Co.	141
Inland Mfg. Div. G. M. Corp.	120
Inland Steel Co.	—
International Nickel Co., Inc., The	2
International Screw Co.	91
—	—
Jenkins Bros.	—
Jessop Steel Co.	—
Johnson Bronze Co.	—
Jones & Lamson Machine Co.	6

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

Govro-Nelson Co., The.....	—
Grand Specialties Co.....	—
Great Lakes Steel Corp.....	—
Greenlee Bros. & Co.....	—
Grizzly Mfg. Co.....	—
Gulberson Diesel Engine Co.....	131
Mall Mfg. Co.....	—
Hansen Mfg. Co.....	—
Harnischfeger Corp.....	12
Harper Co., The H. M.....	91
Harrisburg Steel Corp.....	106
Harvey Machine Co., Inc.....	—
Hayes Industries, Inc.....	—
Heald Machine Co., The.....	—
Herbrand Corp.....	—
Hercules Powder Co., Inc.....	93
Hills-McCanna Co.....	—
Hollingshead Corp., R. M.....	—
Holliston Mills, Inc., The.....	—
Hooen, Owens, Rentschler Co.....	94
Hoover Ball & Bearing Co.....	—
Houdaille-Hershey Corp.....	—
Houghton & Co., E. F.....	—
Howell Electric Motors Co.....	126
Hyatt Bearings Div. G. M. Corp.....	—
Hycar Chemical Co.....	—
Hydraulic Machinery, Inc.....	—
Hydraulic Press Mfg. Co., The....	—
Hydopress, Inc.....	—
Imperial Brass Mfg. Co., The.....	—
Independent Engineering Co.....	—
Indium Corp. of America.....	—
Industrial Gear Mfg. Co.....	141
Inland Mfg. Div. G. M. Corp.....	120
Inland Steel Co.....	—
International Nickel Co., Inc., The	2
International Screw Co.....	91
Jenkins Bros.....	—
Jessop Steel Co.....	—
Johnson Bronze Co.....	—
Jones & Lamson Machine Co.....	68

Kay Products Company.....	—
Kearney & Trecker Corp.....	59
Kellett Aircraft Corp.....	—
Kemp Smith Machine Co.....	—
Kester Solder Co.....	—
Keystone Carbon Co., Inc.....	—
King-Seeley Corp.....	97
Kling Brothers Engrg. Wks.....	—
Kold-Hold.....	—
Koppers Co.....	—
Kropp Forge Aviation Co.....	—

Lamson & Sessions Co.....	91
Landing Gear Div. Bendix.....	—
Lapointe Machine Tool Co.....	—
Layne & Bowler, Inc.....	130
Lear Avia, Inc.....	—
LeBlond Machine Tool Co., R. K.....	—
Leeds & Northrup Co.....	—
Libbey-Owens-Ford Glass Co.....	—
Liberty Motors & Engrg. Corp.....	—
Lincoln Electric Co.....	—
Lincoln Engineering Co.....	112
Lincoln Park Industries.....	—
Lindberg Engineering Co.....	—
Linde Air Products Co.....	—
Lister-Blackstone, Inc.....	—
Littelfuse, Inc.....	64

Advertisers

as a convenience, and not as part
care will be taken to index cor-
for errors or failure to insert.

Littell Machine Co., F. J.....	142
Lodge & Shipley Mach. Tool Co.....	73
Logan Engineering Co.....	—
Long Mfg. Div. Borg-Warner Corp.....	—
Los Angeles Standard Rubber, Inc.....	141

McAleer Manufacturing Co.....	—
McCulloch Engineering Corp.....	95
McQuay-Norris Mfg. Co. (Aircraft Div.).....	—
Mackintosh-Hemphill Co.....	101
Magnaflux Corp.....	—
Mahon Co., R. C., The.....	—
Mallory & Co., Inc., P. R.....	—
Manufacturers Screw Products.....	—
Marman Products Co., Inc.....	—
Mathews Conveyor Co.....	—
Mechanics Universal Joint Divi- sion Borg-Warner Corp.....	140
Mercury Aircraft, Inc.....	130
Merz Engineering Co.....	—
Metal Specialty Co.....	—
Metroloy Co.....	141
Michigan Leather Products Co.....	—
Micromatic Hone Corp.....	—
Midland Steel Products Co.....	—
Mid-States Equipment Co.....	—
Moline Tool Company.....	—
Moraine Products Div.....	—
Morse Chain Co.....	—
Motor Products Corp.....	—
Motor Tool Mfg. Co.....	141
Muehlhausen Spring Corp.....	—
Muskegon Piston Ring Co.....	—

National Acme Co., The.....	100
National Broach & Machine Co.....	—
National Screw & Mfg. Co., The.....	91
National Steel Corp.....	—
National Tube Co.....	123
New Departure Div. G. M. Corp.....	—

Front Cover

New England Screw Co.....	91
Niles Tool Works Co.....	94
North American Electric Lamp Co.....	—
Northern Indiana Brass Co.....	67
Norton Company.....	—
Nox-Rust Corporation.....	—

Ohio Rubber Co.....	—
O'Neil-Irwin Mfg. Co.....	—
Onsrud Machine Wks., Inc.....	—

Paasche Airbrush Co.....	—
Page Steel & Wire Div. American Chain & Cable Co., Inc.....	113
Panelite Div., St. Regis Paper Co.....	—
Parish Pressed Steel Co.....	61
Parker Co., The Charles.....	91
Parker-Kalon Corp.....	91
Pawtucket Screw Co.....	91
Pease Co., The C. F.....	—
Pedrick Piston Rings.....	—
Peerless Machine Co.....	133
Pennsylvania Salt Mfg. Co.....	—
Perfex Gage & Tool Co.....	—
Permatex Co., Inc.....	—
Pesco Products Co.....	—
Pheoll Mfg. Co.....	91
Phillips Screw Mfrs.....	91
Physicists Research Co.....	—
Pierce Governor Co., The.....	—
Pioneer Rubber Co.....	—
Pittsburgh Lecomelt Furnace Corp.....	—
Pittsburgh Plate Glass Co.....	—
Porter-Cable Machine Co.....	—
Potter & Johnston Machine Co.....	143
Poulsen & Nardon, Inc.....	—
Powder Metallurgy Corp.....	—
Pratt & Whitney (Division Niles- Bement-Pond Co.).....	107
Preis Engraving Mach. Co., H. P.....	143
Progressive Mfg. Co., The.....	—
Purolator Products, Inc.....	—

Racine Tool & Machine Co.....	—
Ramsey Access. Mfg. Corp.....	—
Reading Screw Co.....	91
Reeves Brothers, Inc.....	—
Republic Steel Corp.....	—
Resistoflex Corp.....	—
Reynolds Metals Co.....	—
Rhode Island Tool Co.....	129
Rhodes & Co., Jas. H.....	—
Rockford Die & Tool Works, Inc.....	142
Rockford Drilling Machine Div.....	—
Rodic Rubber Corp.....	—
Rohm & Haas Co.....	—
Russell, Burdall & Ward Bolt & Nut Co.....	91
Ryerson & Son, Inc., Joseph T.....	—

SKF Industries, Inc.....	102
Saginaw Malleable Iron Div. G. M.....	78
Salisbury Axle.....	61
Sav-way Industries.....	—
Scandia Mfg. Co.....	—
Schrader's Son, A.....	—
Sclaky Bros.....	9
Scovill Mfg. Co.....	91
Scully-Jones & Co.....	—
Sealed Power Corp.....	—
Seneca Falls Machine Co.....	5
Shakeproof, Inc.....	91
Sheffield Corp., The.....	—
Sheldon Machine Co.....	—
Shore Instrument & Mfg. Co., The.....	143
Shuler Axle Co., Inc.....	Back Cover
Siewek Engineering Co.....	—
Silent Hoist Winch & Crane Co.....	—
Simmonds Aerocessories, Inc.....	77-143
Simplex Products Corp.....	—
Snap-on Tools Corp.....	—
Snyder Tool & Engrg. Co.....	—
South Bend Lathe Works.....	98
Southington Hardware Mfg. Co.....	91
Speedway Mfg. Co.....	—
Spencer Turbine Co.....	—

Sperry Products, Inc.....	125
Spicer Mfg. Corp.....	61
Square D Company.....	—
Standard Molding Corp.....	—
Standard Oil Co. (Ind.).....	2nd Cover
Standard Pressed Steel Co.....	88-89
Sterling Aluminum Products, Inc.....	—
Sterling Tool Products Co.....	—
Stow Manufacturing Co.....	—
Strom Steel Ball Co.....	68
Stromberg Carburetor Div. Bendix.....	—
Stromberg-Carlson Co.....	—
Stuart Oil Co., Ltd., D. A.....	—
Sturdimatic Tool Co.....	—
Sturtevant Co., P. A.....	129
Superior Coach Corp.....	132

Terry Co., Geo. A.....	—
Texas Co., The.....	6
Thompson-Bremer & Co.....	—
Thompson Mfg. Co., Earl A.....	—
Timken Roller Bearing Co., The.....	—
Tinnerman Products, Inc.....	—
Titeflex, Inc.....	96
Tobe Deutschman Corp.....	—
Tomkins-Johnson Co.....	—
Torrington Co., The.....	53-146
Tube-Turns, Inc.....	65-66
Tung-Sol Lamp Works, Inc.....	—
Turco Products, Inc.....	—
Turner Gauge Grinding Co.....	—
Tuthill Pump Company.....	—
Twin Disc Clutch Co.....	—

U. S. Automatic Corp.....	—
Udylite Corp., The.....	110
Union Carbide & Carbon Corp.....	—
United Screw & Bolt Corp.....	103
United Specialties Co.....	4
United States Rubber Co.....	—
United States Steel Corp.....	123
United States Tool & Mfg. Co.....	—

Van der Horst Corp. of Amer.....	—
Vard, Inc.....	—
Vascoloy-Ramet Corp.....	142
Vickers, Inc.....	51
Victor Mfg. & Gasket Co.....	142
Vinco Corporation.....	—
Visco-Meter Corp.....	—
Vulcan Corp.....	—

Waldes-Koh-I-Noor, Inc.....	—
Walker-Turner Co., Inc.....	—
Warner Electric Brake Mfg. Co.....	7
Watson-Stillman Co., The.....	134
Waukesha Motor Co.....	—
Weatherhead Co.....	—
Wells Mfg. Corp.....	—
Western Automatic Mach. Screw Co.....	—
Western Felt Works.....	74
Westinghouse Elec. & Mfg. Co.....	80
Whitaker Battery Supply Co.....	—
White Dental Mfg. Co., The S. S.....	—
Whitney Metal Tool Co.....	—
Whitney Screw Corp.....	91
Wilcox Rich Div.....	—
Wilkening Mfg. Co.....	—
Wilson Welder & Metals Co., Inc.....	—
Wittek Mfg. Co.....	143
Wolverine Tube Div.....	—
Worcester Stamped Metal Co.....	142
Worthington Pump & Machy. Corp.....	—
Wrigley, Jr., Co., Wm.....	72
Wright Mfg. Div. American Chain & Cable Co., Inc.....	—
Wyman-Gordon.....	76

Yoder Co., The.....	116
Young Radiator Co.....	3
Young Spring & Wire Corp., L. A.....	—

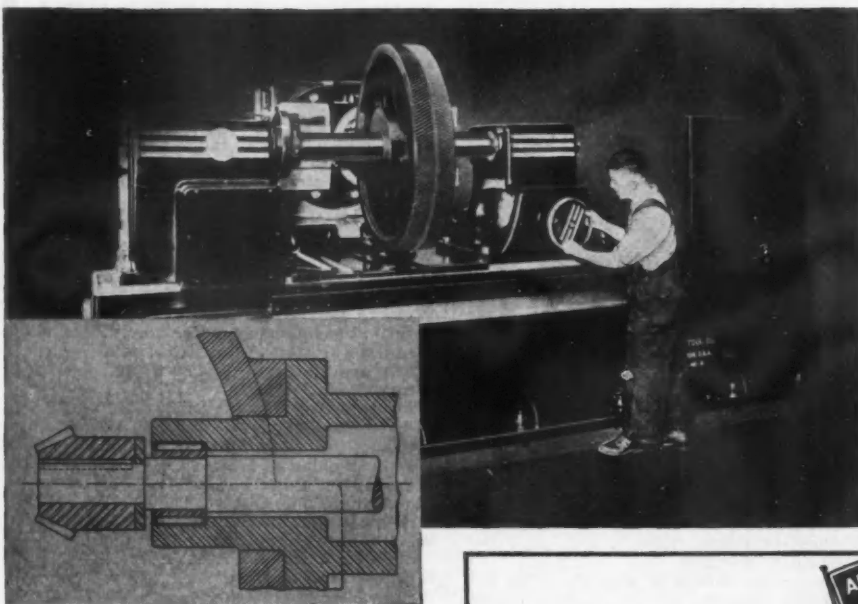
Zollner Machine Works.....	3rd Cover
----------------------------	-----------

IN THE NEWS

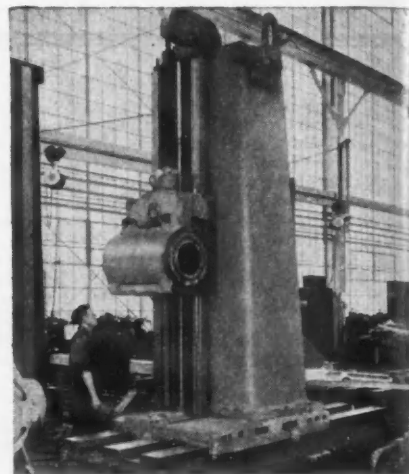
WITH TORRINGTON BEARINGS



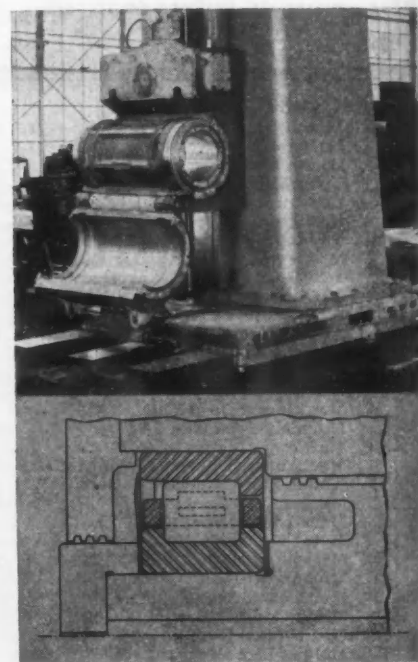
TANK BUSTERS must pack the power not only in armament but for locomotion as well. The M-12 shown here which mounts a 155 MM. field gun and designed to have all the speed and mobility of a tank, was among the first of our Army's fleet of tank destroyers. In the compact, efficient power plants of these modern weapons are small, heavy duty Torrington Needle Bearings—used to carry and transmit the heavy loads under the toughest imaginable service conditions. For applications such as automotive transmissions, universals and differentials, the high unit capacity, small size and efficient lubrication of Needle Bearings make them ideal for all radial load applications.



GEARS FOR TURBINES up to 4 feet in diameter and 20-inch face width are processed on this Michigan Tool Company's gear finishing machine. Several key points in the infeed mechanism are mounted on Torrington Needle Bearings to insure smooth, frictionless operation. Typical is the application of a Torrington Type DC Needle Bearing (with hardened inner race) on the hand operated infeed shaft shown in the cross-section.



SUPPORT FOR A 24-FOOT BORING BAR is the job of this large end support bearing for a floor type horizontal boring, drilling and milling machine photographed in the shops of Giddings & Lewis Machine Tool Company. Supporting this huge shaft in the housing shown open in the close-up photo (below) are two special 18-inch O. D. radial roller bearings supplied by Torrington's Bantam Bearings Division. These bearings illustrated in the cross-section illustrate the type of service Torrington is equipped to render in the design and manufacture of special bearings to meet the unusual and out-of-the-ordinary bearing requirements. Why not TURN TO TORRINGTON for specialized assistance on your next bearing problem?



TORRINGTON BEARINGS

ARMY NAVY

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION

SOUTH BEND 21, INDIANA



THE *Right* *Piston*

FOR EVERY
HEAVY DUTY
ENGINE SERVICE

*Original Equipment in
America's Finest Motors*

WAUKESHA

FEDERAL

CORBETT

GMC

HERCULES ENGINES

MACK

LANOVA

CONTINENTAL

STUDEBAKER

CUMMINS

FWD

BUDA

MARMON-HERRINGTON

REO

GUIBERSON

HALL-SCOTT

IHC

DIAMOND-T

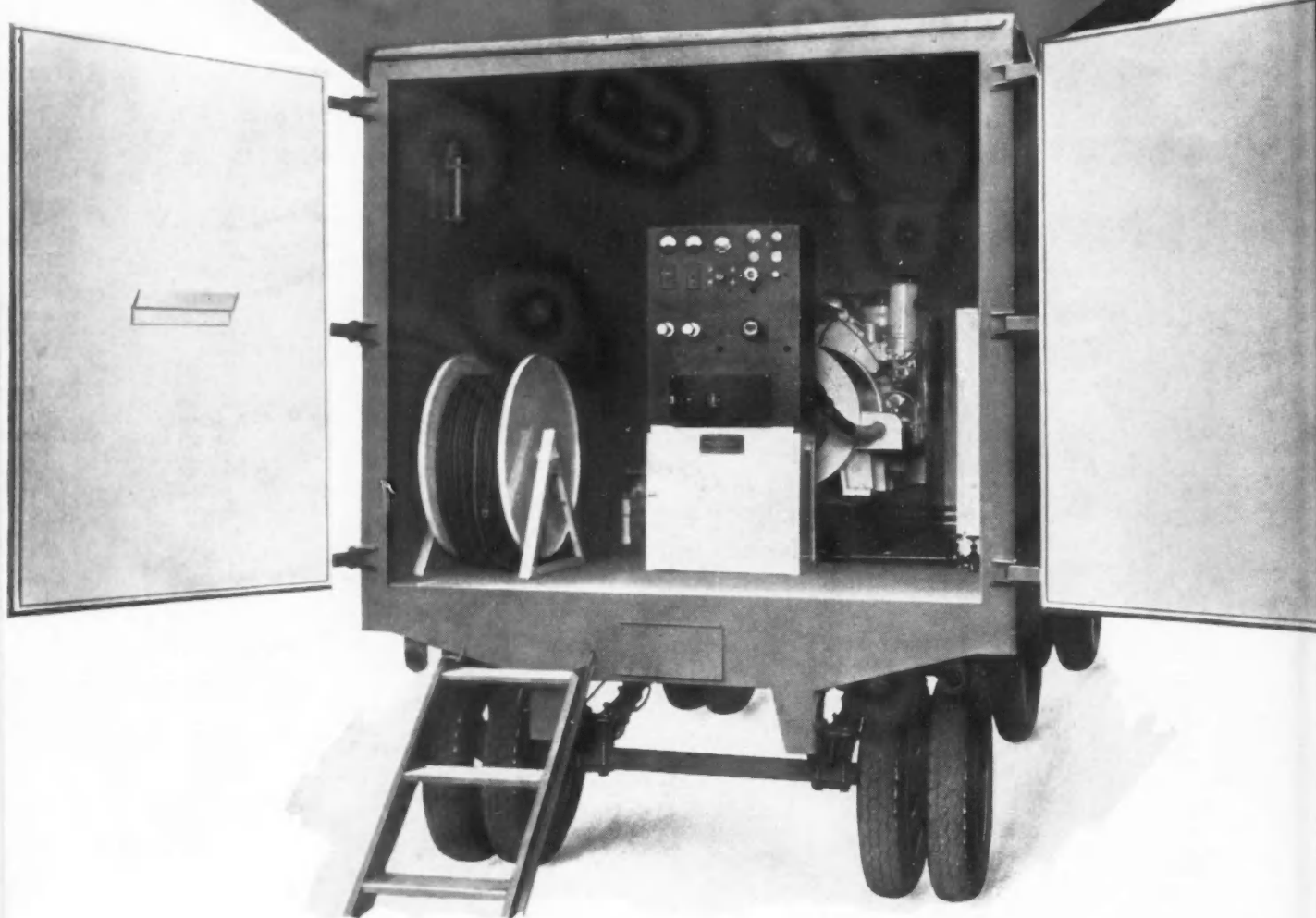
For Internal Combustion Engines • Both Gasoline and Diesel

ZOLLNER

PISTON EQUIPMENT

ZOLLNER MACHINE WORKS • • FT. WAYNE, INDIANA

SHULER AXLES FOR LUFKIN!



In designing any such equipment as a mobile Diesel generator unit, its builders know in advance that they must provide the sort of dependability that defies any emergency situation, including poor roads or *no* roads. . . . That's why we're proud that Lufkin

uses Shuler Axles in the type of equipment shown above. Not only because it's still another opportunity to do our part in this War, but also to continue learning things that will help us to supply even better commercial axles when Peace comes back again.

SHULER AXLE CO., *Incorporated*, LOUISVILLE, KY.

Export Division: 38 Pearl St., New York, N. Y.

West Coast Warehouse: Ford & Derby Streets, Oakland, Calif.